AR TARGET SHEET

The following document was too large to scan as one unit, therefore it has been broken down into sections.

DOCUMENT # HNF-CM-7-7

EDMC # 0047283

SECTION 2 OF 2

TITLE:

BIOTIC SURVEYING AND SAMPLING

Approved by

M. R. Adams, Manager
Environmental Restoration Engineering

1.0 PURPOSE

The purpose of this Environmental Investigations Instruction (EII) is to implement requirements applicable to biotic surveying and sampling performed in support of environmental investigations.

2.0 SCOPE

This EII applies to all biotic surveying and sampling performed by the Environmental Engineering and Geotechnology Function (EE&GF) or its subcontractors in accordance with contract documents. The procedures for performing specific surveying and sampling tasks will be issued as appendices to this EII, as needed.

3.0 DEFINITIONS

See the Glossary/Acronyms section of this manual.

4.0 RESPONSIBILITIES

4.1 Field Team Leader

The Field Team Leader (FTL) *will:*

1. *Ensure that* all required permits have been obtained.
2. Obtain unique Hanford Environmental Information System (HEIS) sample number(s) from the Office of Sample Management in accordance with EII 5.10.

4.2 Sampling/Surveying Team

The Sampling/Surveying Team is designated by and reports to the FTL. The Sampling/Surveying Team *will*:

1. Perform all sampling and surveying in strict accordance with the work plan and as directed by the FTL.
2. Maintain communications with the FTL, as required by the work plan.

3. Complete field logbooks to the extent required by this EII and in accordance with EII 1.5.

4. For sampling operations, complete and transmit the Biota Identification Data Entry Forms and Sample Identification Data Entry Forms to the project coordinator.

5. Complete Sample Analysis Requests in accordance with EII 5.2.

6. Determine proper sample container characteristics based on the guidelines of this EII.

7. Obtain, characterize, label, and seal individual samples.

8. Maintain field custody (in accordance with EII 5.1) of all samples pending transportation to the analytical laboratory.

9. Perform nonradiological chemical decontamination of sampling equipment at the direction of the FTL.

5.0 REQUIREMENTS

5.1 Designated Reviewing Organizations

Organizations designated to review changes to this document are listed below. The controlled manual point-of-contact (CMPOC) listed for the designated reviewing organization(s) is responsible for coordinating the review and consolidating and submitting comments to the originating organization.

Designated Reviewers	CMPOC
None	None

Comments from other organizations are welcome; however, such courtesy comments are resolved at the option of the originating organization.

5.2 Safety Requirements

All sampling and surveying activities shall comply with the site-specific health and safety document requirements for access control, monitoring of radiation hazards and personal protective equipment.

5.3 Training

1. Personnel responsible for biotic sampling or surveying shall be *qualified* for the biota to be sampled or surveyed *based upon formal education or experience within the area of life sciences as required at the discretion of the manager* and be qualified in accordance with EII 1.7. Other personnel may assist in biotic sampling activities under the supervision of qualified personnel.

2. Personnel shall be trained and qualified in accordance with EII 1.1 (when required) to perform work at a hazardous waste site.

5.4 Sampling Prerequisites

1. A prejob safety meeting shall be held to discuss the site-specific safety requirements, e.g., personal protective equipment, access control, radiation monitoring. The general scope of sampling and surveying operations shall also be discussed.

2. Review of applicable parts of the work plan and familiarization with sampling areas and known areas of contamination *shall be performed*.

3. Sufficient quantities of laboratory-prepared containers shall be available for expected sample types, with accommodation for additional sampling, breakage, etc.; adequate supplies of sample seals, labels, caps, preservatives, cold packs, coolers and other required items shall be available onsite.

4. Required equipment shall be available and decontaminated in accordance with EII 5.5.

6.0 PROCEDURE

The nature of biotic surveys and sampling dictates that site- and project-specific procedures be developed. These procedures depend on such variables as the type of plant or animal surveyed or sampled, time of year, data required and habitat. Specific procedures have been, and will continue to be, added as appendices to this EII.

6.1 Sampling Operations

1. Once the prerequisites in Section 5.3 have been completed and appropriately documented, the FTL authorizes the start of sampling operations.

2. *The work plan or Description of Work (DOW) defines sample types, methods, locations, numbers of splits, field blanks, spikes, and duplicates. The site QA Project Plan defines numbers of splits, field blanks, spikes and duplicates.*

3. The appendices to this EII *define* individual sampling and surveying methods.

4. *U*se the field logbook to document significant site activities during field operations. Other variables to be noted in the field logbooks include weather, date, time, personnel present and location of activity.

6.2 Sample Preservation and Handling

1. The sampler selects *sample containers* based on the guidelines in the appendices *to this EII*, the work plan, and analytical laboratory requirements.

2. Where laboratory-prepared containers are required, *do not use containers having* missing container preparation codes or damaged seals.

3. *The work plan or DOW specifies* use of sample preservatives, introduction of spike compounds, and special considerations for volatile organic constituent testing.

4. The sampler seals, labels, and stores the sample in the required cooler or shipping container.

6.3 Chain of Custody/Sample Analysis Request

1. *Enter* information for each sample on a Chain of Custody form in accordance with EII 5.1. The sample container must remain within visual range of the sampler at all times, kept in a controlled access area, or locked to prevent tampering or damage until turned over to the transporter.

2. *Prepare* a Sample Analysis Request to accompany the samples to the analytical facility to ensure the correct analysis is performed. The WHC Sample Analysis Request form is shown in EII 5.2. The project coordinator may choose to use a different form specific to the analytical facility.

6.4 Sample Packaging and Shipping

Package and ship *samples* in accordance with EII 5.11.

6.5 Records

Records are processed and dispositioned in accordance with the following table.

NAME Filing Unit Title or Description	RECORD TYPE*	RETENTION PERIOD	DISPOSAL AUTHORITY	CUT-OFF AND RETIREMENT INSTRUCTIONS
Field Logbook(s)	*QA*	*TPA + 10 years*	*DRS 1.8c Force Fit TBD*	*Submit weekly copies to file custodian (FC); submit completed logbook to FC upon project completion or when no longer needed for transmittal to IRM permanent storage.*
Biota Identification Data Entry form(s)	*NR*	*Until no longer needed*	*NR*	*Transmit to project coordinator for subsequent entry into HEIS*
Sample Identification Data Entry form(s)	*NR*	*Until no longer needed*	*NR*	*Transmit to project coordinator for subsequent entry into HEIS*

** QA = Quality Assurance; NR = Nonrecord Material; TBD = To be determined*

7.0 REFERENCES

American Ornithologist's Union, Checklist of North American Birds, Washington, D. C.

Field Guide to the Birds of North America, National Geographic Society, Second Edition, 1987.

Flora of the Pacific Northwest, C. L. Hitchcock and A. Chronquist, University of Washington Press, Seattle, WA, 1973.

Wildlife Management Techniques, Wildlife Society, Bethesda, MD.

WHC-CM-3-5, Document Control and Records Management, Section 9, "Quality Assurance Records."

APPENDIX A

QUALITATIVE ANIMAL SURVEYS

1.0 APPLICABILITY

This appendix is to be used when qualitative verification of species lists already established is required. It does not allow for counting individual animals (e.g., number of birds or mammals of each species) or verifying the presence of each species identified in the species list. Because of daily, seasonal, and yearly fluctuations in wildlife populations, such quantitative information would require many surveys over several years to be accurate and may be of limited usefulness. The qualitative verification of the species list is mainly to provide evidence that the CERCLA or RCRA site is as described or deduced from the literature and *possibly* supplement that list.

2.0 EQUIPMENT

The FTL ensures that the following equipment is available:

1. Field logbook.
2. Binoculars of at least 7 x 35 power.
3. Standard field identification guides (e.g., <u>Field Guide to the Birds of North America</u>, National Geographic Society, Second Edition, 1987).
4. Transportation vehicles.

3.0 PROCEDURE

3.1 Bird Surveys

A minimum of two walkover surveys will be conducted during the breeding season. Walkover surveys may also be conducted during the winter or spring and fall migration periods if important species such as threatened and endangered species or birds of commercial importance (e.g., hunted species) are expected to occur only during those seasons. Those species identified by sight or song will be entered in the field logbook. Binoculars and a field identification guide will be used when there is any doubt as to species. The breeding season surveys will commence within 1 hour of sunrise, the period of highest bird activity. The surveys will be conducted under conditions of good visibility (at the direction of the FTL), calm or light wind, and no or light precipitation.

Animal surveys may be conducted in different types of areas. Riparian bird surveys will be conducted by walking within 50 m of the daily high-water mark. Surveys in enclosed areas (e.g., reactor areas) will be walked in lines 50 to 100 m apart (lines walked through areas with many buildings will be closer; lines walked in more open areas with long visibility can be wider). Each line in an enclosed area shall be from the boundary fence on one side of the operable unit to the opposite fence, where possible.

Special attention will be given to species listed as threatened or endangered, species hunted for food off the Hanford Site, or birds that display behavior that could result in transport of significant contaminants (e.g., swallows gathering mud from waste sites for nest material). Birds will be identified according to names given in the latest American Ornithologist's Union (AOU) checklist.

3.2 Mammal Surveys

Surveys for mammals will be conducted by two methods. Mammal surveys in riparian and reactor areas may be conducted simultaneously with the bird surveys there, or they may be conducted independently. If conducted independently, mammal surveys will also be walked within 50 m of the daily high-water mark. Because mammals are less likely to be seen or heard than birds, mammal signs such as diggings, burrows, browsing, tracks, or scat will be identified as to probable species.

Mammals have been identified as important possible vectors in the transport of contaminants. Thus, surveys will also be conducted around known waste sites in the reactor areas. Facility maps will be obtained for the area to be surveyed. Waste sites identified on the maps will be surveyed for mammal signs, especially burrowing activity, by walking the perimeter of the waste site (if in a radiation zone), and by walking 10-m-wide lines over the top (if not in an exclusion zone). Each designated waste site will be individually surveyed and noted in the field logbook. These surveys will be conducted during the spring or summer seasons. Some of the sites may be surveyed more than once if activity on the waste sites is suspected but not observed on the first survey.

3.3 Insect Surveys

Certain insects, such as harvester ants, are known to burrow deeply and thus have been identified as possible vectors for contaminant transport. Surveys for such significant insect activity will be conducted concurrently with the mammal surveys around known waste sites. Current significant (in the judgment of the FTL) insect activity and evidence of past activity will be noted in the field logbook.

APPENDIX B

VEGETATION SURVEYS

1.0 APPLICABILITY

This appendix is to be used when plant surveys are needed to make initial, broad surveys to delineate plant community types and compile species inventories within each community type.

2.0 EQUIPMENT

1. Field logbook
2. Portable plant press
3. Access to a permanent herbarium.

3.0 PROCEDURE

3.1 Plant Community Delineation

Plant communities over the area designated (either in the work plan or by the project coordinator or designee) will be defined by the dominant plant species or unique combination of species that occur in each of the different physiognomic, soil, and topographic units. The delineations will be based on visual inspections and are intended to define the general associations of species. Because trees are important components of the Hanford Site ecosystem, the location of stands of trees will also be noted. Important populations of other plants that have been identified as possible pathways for contaminants (e.g., reed canarygrass, asparagus, and other commonly used, edible plants) will also be recorded.

Once the community types are defined, species inventories within each type will be compiled. This will be accomplished by walking within each community. In addition, each of the known waste disposal sites within any operable units to be inventoried will be specifically examined, and all species encountered will be entered in the field logbook. The species inventories will be conducted from April through June, or when the majority of species are identifiable. Supplemental surveys may be conducted later in the year to search for late-blooming species such as *Columbia* yellowcress (Rorippa columbiae) when such species are suspected to be present.

Species identifications will be based on Flora of the Pacific Northwest, unless otherwise noted in the field logbook. The inventory process will provide a basis for determining the presence or absence of species of special interest such as rare, endangered, threatened, sensitive, or monitor species within each community type. Special consideration will be given to areas that are most likely to contain species of special interest (e.g., river banks for *Columbia* yellowcress). All threatened and endangered species identification will be performed with the guidance of botanists from the Washington State Natural Heritage Foundation.

All field notes, maps, and species identifications will be entered into a field logbook in accordance with EII 1.5. Any plant specimens collected will be kept in the field press and later stored in a permanent herbarium, if necessary.

APPENDIX C

VEGETATION SAMPLING

1.0 APPLICABILITY

This appendix will be used when sampling vegetation for environmental characterization activities.

2.0 EQUIPMENT

1. Field logbook.
2. Biota Identification Data Entry Forms and Sample Identification Data Entry Forms.
3. Maps of collection area.
4. Sampling shears or knife.
5. Waterproof ink pens and sample identification tags/labels.
6. Clean, unused plastic freezer bags (1-gallon size) or paper bags and masking tape.
7. Ice chest with ice or blue ice.
8. Scale (1 kilogram capacity).

3.0 PROCEDURE

The general areas to be sampled will be determined by the work plans or the Project Coordinator. Specific locations will be determined by the FTL; sites close to springs or known waste sites are preferred, if available. The locations of all collections will be noted on a map (*the largest available scale*) and recorded in the field logbook. Chain of custody will be maintained in accordance with EII 5.1. Shipment of samples to the laboratory will be in accordance with EII 5.11.

3.1 Human-Edible Plants

The plant species to be analyzed will be collected when they are in their most edible stage (e.g., early spring for asparagus). Plants are collected by removing the part(s) normally consumed and placing it in a plastic or paper bag. The sampler fills the bag with *at least* 300 grams wet weight, but the actual amount may be less because of a limited amount of material available. The sample identification tag/label is affixed to the bag, then the bag is sealed and stored on ice or blue ice in an ice chest.

3.2 Other Plants

Material from these plants can be collected anytime during the spring and summer, as long as the plant has green leaves. A portion of the plant part(s) most likely to be in a transport pathway (e.g., grass leaves, twigs and leaves of shrubs) are collected and placed in a plastic or paper bag. The sampler fills the bag with *at least* 300 grams wet weight, but the actual amount may be less because of a limited amount of material available. The sample identification tag/label is affixed to the bag, then the bag is sealed and stored on ice or blue ice in an ice chest.

1.0 PURPOSE

This Environmental Investigations Instruction (EII) establishes methods for cleaning and/or decontaminating tools and equipment used in site characterization and monitoring activities.

2.0 SCOPE

This EII applies to equipment cleaning and/or decontamination activities.

3.0 RESPONSIBILITIES

3.1 Decontamination Personnel

Cleaning and/or decontamination personnel may include, but are not limited to, drilling personnel and laborers who are responsible for conducting activities in accordance with this EII.

3.2 Site Safety Officer

1. Notifies the Field Team Leader (FTL)/Field Team Coordinator (FTC) of potential nonradiological health and safety hazards.

2. Has the authority to halt decontamination activities for nonradiological health and safety hazards.

3.3 Health Physics Technician (HPT)

1. Performs surveys to determine the radiological status of areas, materials, and equipment.

2. Has the authority to halt decontamination activities for radiological hazards.

3. Prepares Radiation Work Permits (RWPs) for regulated equipment and assists in the direction of specific radiological cleaning/decontamination activities.

4.0 REQUIREMENTS

4.1 Safety Requirements

All activities shall comply with the applicable site-specific safety documents (e.g., Hazardous Waste Operations Plan [HWOP], Job Safety Analysis, site-specific safety plan) for access control, monitoring hazards, and personnel protective equipment.

*Editorial and reformatting are the only changes to Rev 5, Change 2.

4.2 Documentation

The person performing the cleaning and/or decontamination activity shall complete and sign the Field Cleaning and/or Decontamination form, Figure 1.

4.3 General Cleaning and/or Decontamination Requirements

4.3.1 Cleaning Requirements

Cleaning shall comply with WAC-173-160-530. This requires that the drill rig and all downhole equipment used when drilling in known contaminated or potentially contaminated sites be steam cleaned before and after each use.

1. The drill rig and all downhole equipment shall be steam cleaned prior to mobilization to any site. Previously cleaned drilling equipment (documented as clean) normally does not require re-cleaning prior to use.

2. Steam cleaning of the drill rig is not required when drilling more than a single borehole at the same hazardous waste site (e.g., crib, trench, pond and/or landfill). However, all downhole equipment shall be decontaminated between boreholes on the same hazardous waste site.

3. Rinsate generated during steam cleaning is exempt from collection if generated outside the boundaries of a known waste site and if the equipment being cleaned was not associated with soil/drill cuttings collected as suspected hazardous or radioactive waste.

4. Rinsate from steam cleaning of regulated equipment will be collected until released by HPT.

5. Cleaning shall include the removal of all marking compounds and coatings from the downhole equipment, permanent casing, and the inside of temporary casing.

4.3.2 Decontamination Requirements

Decontamination is required after operating in a known waste site or if detectable hazardous and/or radioactive material are encountered. Decontamination is conducted to minimize the potential for cross contamination.

1. Radiological decontamination shall be performed prior to nonradiological decontamination.

2. Decontamination fluids shall be collected and the material managed in accordance with the applicable procedure (EII 4.2 or EII 4.3).

3. Decontamination fluids will be collected when drilling is conducted in a known hazardous waste site or when drill cuttings/soils are labeled suspect hazardous or radioactive waste.

5.0 PROCEDURE

5.1 Steam Cleaning

The following applies for steam cleaning (washing) the drill rig when decontamination is not required. Steam cleaning (washing) requirements are a minimum of 80 psi and 180°F.

1. Each drill rig will be steam cleaned between potentially hazardous waste sites. The rinsate from this steam cleaning (washing) does not require collection except as noted in 4.3.1, step 4 of this EII. The FTL/FTC will determine if an absorbent pad is required during steam cleaning operations.

2. Equipment that has been successfully decontaminated may be washed at the discretion of the FTL/FTC. In this case the fluids do not have to be collected.

5.2 Decontamination

Decontamination of the drill rig and drilling equipment is required if operating inside a known waste site or if the equipment being cleaned was associated with soils/drill cuttings collected as suspected hazardous or radioactive waste.

Field decontamination activities are described below.

1. Radiological decontamination consisting of wiping and other nonsteam cleaning or pressure washing methods.

2. Nonradiological decontamination consisting of scrubbing, wiping, flushing, rinsing and steam cleaning methods.

3. Steam cleaning/pressure washing can be done on chemically and fixed radiologically contaminated equipment when a method is available to collect rinsate.

4. Sampling equipment used to obtain physical samples shall be decontaminated in accordance with this EII before it is transported to the *6268 cleaning* facility for *cleaning/* decontamination in accordance with EII 5.5 of this manual. Equipment that is not successfully decontaminated will not be transported to the facility and must be stored in accordance with EII 4.4 of this manual.

5. All water used for decontamination activities shall be potable water (for example, Hanford System or City of Richland water) or Columbia River raw water drawn from Hanford Site raw water supply points.

6. All decontaminated materials and equipment shall be stored in a manner to minimize the possibility of recontamination.

7. Decontamination fluids shall be designated and managed in accordance with EII 4.2 or EII 4.3 of this manual.

5.2.1 Radiological Decontamination

Survey and unconditional radiological release is the criterion for successful radiological decontamination.

If unable to eliminate fixed radioactive contamination, the FTL/FTC will decide whether to control the equipment as radioactive material or dispose of it as radioactive waste.

Before it is taken from the site, equipment designated for disposal shall be decontaminated to remove nonradiological hazards.

The following methods may be used to perform radiological decontamination.

1. **Wiping.** This method consists of wiping the contaminated equipment with clean paper towels and/or clean rags. It is often performed to prevent the spread of radioactive contaminants as the equipment (drill string, sampler, casing, or drill line) is being removed from the borehole. When all smearable radiological contamination has been removed, the equipment will be cleaned or decontaminated to remove chemical contaminants as required before it is reused or transported to another site.

2. **Abrasive Method.** This method is used in the field to remove fixed radioactive contamination after all the smearable radioactive contamination has been eliminated. The abrasive cleaning method is used to remove small isolated areas of fixed radioactive contamination on equipment. It consists of scrubbing the contaminated area with a wire brush, sandpaper or other mechanical means using an approved cleaner or removing a thin layer of metal using a metal file, sandpaper (garnet, silicon dioxide grit). The equipment will be cleaned or decontaminated to remove chemical contaminants as required before it is reused or transported offsite.

5.2.2 Nonradiological Decontamination

Nonradiological field decontamination is accomplished by using one or more of the following techniques and occurs if the HPT has determined that smearable radiological contaminants are not present.

The criterion for nonradiological field decontamination is successful completion of one or more of the following methods with no visible residues remaining.

1. **Steam Cleaning/Pressure Washing Decontamination.** All exposed surfaces of the equipment are steam cleaned or pressure washed with an approved cleaner, such as Built Laundry Detergent[1] or Simple Green[2]. The equipment is then rinsed with water.

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[1]Klix Corporation, San Francisco, CA

[2]Sunshine Makers, Huntington Harbor, CA

2. **Wash Basin Decontamination.** Decontamination activities using tanks or other fluid containment vessels shall be done so that all contaminated dirt or potentially contaminated rinsate is collected. The equipment can be brushed, wiped, or swabbed using an approved cleaner, such as Built Laundry Detergent or Simple Green. The equipment is then rinsed with water.

3. **Rinsing/Flushing Decontamination.** Pumps used for well development are decontaminated by flushing water through the pump assembly. Connect the pump to the discharge tubing, submerge the pump in potable water or Columbia River raw water, energize the pump, and run approximately 30 gallons through the pump and tubing. The water flushed through the pump shall be contained and handled in the same manner as well development waste water as specified in EII 10.3 of this manual.

4. **Wiping.** This method consists of wiping the contaminated equipment with clean paper towels, or clean rags, using approved cleaners, such as Built Laundry Detergent or Simple Green. It is often performed to prevent the spread of contamination as the equipment (drill string, sampler, casing, drill line, etc.) is being removed from the borehole.

5.3 Decontamination Fluids

Decontamination wash and rinse fluids shall be collected when required and contained in impoundment reservoirs consisting of one or more of the following:

1. **Plastic sheeting.** Used in the field when decontaminating drill rigs or other large pieces of equipment. Plastic sheeting must be arranged to collect fluids if this method is used.

2. **Wash basins.** Tanks or other fluid containment vessels used in hand washing, rinsing/flushing, and scrubbing/brushing methods in the field.

3. **Fluid collection sumps.** Usually associated with wash pads at a specialty facility where equipment would be transported for steam cleaning and/or pressure washing operations.

5.4 Records

Records generated during implementation of this EII are processed as follows:

Name, Filing Unit or Description	**Record Type***	**Retention Period**	**Disposal Authority**	**Cut-off and Retirement Instructions**
Field Cleaning and/or Decontamination (BC-6000-292)	QA	TBD	TBD	Transmit to FC upon completion for submittal to IRM permanent storage per approved RIDS. Copies for project file are obtained prior to transmittal to permanent storage.

* QA = Quality Assurance; TBD = to be determined

6.0 DESIGNATED REVIEWING ORGANIZATION

The organization designated to review changes to this document is Hanford Technical Services (HTS), the process owner. Comments from other organizations are welcome; however, comments are dispositioned at the option of HTS.

7.0 FORM

Field Cleaning and/or Decontamination (BC-6000-292)

8.0 BIBLIOGRAPHY

HSRCM-1, *Hanford Site Radiological Control Manual.*

WAC-173-160, "Minimum Standards for Construction and Maintenance of Water Wells."

WHC-CM-3-5, *Document Control and Records Management Manual*, Section 5, "Records Storage, Retrieval, and Destruction."

WHC-CM-7-5, *Environmental Compliance.*

Figure 1. Field Cleaning and/or Decontamination. (BC-6000-292)

Well ID	FIELD CLEANING AND/OR DECONTAMINATION

Project: ______________________

Location of Cleaning/Decontamination: ______________________ Borehole: ____________

Destination: ______________________

The following equipment has been decontaminated following WHC-CM-7-7 EII 5.4 Rev. _____

List types of detergent: ☐ Non-phosphate ☐ Other ______________

Rigs

	Equipment	ID No.
☐		
☐		
☐		
☐		

Cleaning ☐ Yes ☐ No

Decontamination ☐ Yes ☐ No

Downhole Equipment

			Size	Date
☐		Ea.		
☐		Ea.		
☐		Ea.		
☐		Ea.		
☐		Ea.		
☐		Ea.		
☐		Ea.		
☐		Ea.		
☐		Ea.		
☐		Ea.		
☐		Ea.		
☐		Ea.		
☐		Ea.		
☐		Ea.		

Remarks: ______________________

Person Conducting Decontamination (Print/Sign Name) ________ Date ________

Reviewed By FTL/Designee ________ Date ________

DISTRIBUTION: White - Field File Custodian Yellow - Group Files Pink - Field Team Leader

BC-6000-292 (02/95)

INSTRUCTION CHANGE AUTHORIZATION

ICA No. 060

Instruction (EII) No.	Rev. No.	
EII 5.5, 1706 KE Laboratory Decontamination of RCRA/CERCLA Sampling Equipment	2	Page 1 of 1

Description of Change — Impact level 4

This EII does not apply to sampling equipment to be used for Task 5b and 5c of the 300-FF-5 Remedial Investigation--Surface Water and Sediment Investigation. All sampling equipment for this task will be decontaminated as outlined in the Sampling and Analysis Plan for this project (WHC-SD-EN-AP-107).

[x] One Time [] Permanent

Justification

This sampling event will be carried out by PNL sampling staff and the timing will be dependent upon an abnormally low river flow stage. The sampling will need to be completed in a time "window" arranged with the dams controlling the river flow. This "window" can only be maintained for 2 or 3 days at the most, due to this constraint it is necessary to use rigorous field decon techniques for the sampling equipment, rather than more time consuming laboratory decon techniques such as those outlined in this EII.

Approvals: (Type/Sign Name and Date)

B. E. Innis *Brian E. Innis*	8-27-92	R. A. Carlson *L. C. Hulstrom for*	8/27/92
ICA Author	Date	ICA Author's Manager	Date
W. L. Johnson *W L Johnson*	8/28/92	N/A	
EII Author's Manager	Date	Quality Assurance (If Required)	Date
		N/A	
		Safety (If Required)	Date

A-6000-370 (12/91) (EF) WEF158

INSTRUCTION CHANGE AUTHORIZATION (ICA)

ICA No. 100

Instruction No.	Rev. No.	
WHC-CM-7-7, EII 5.5, "Laboratory Cleaning of RCRA/CERCLA Sampling Equipment	Rev. 4	Page 1 of 1

Description of Change

Approval Designator Q

EII 5.5 states that the oven temperature must be set to 100 degrees Celsius and that stainless steel equipment be baked at this temerature. Lately there have been complications with the operation of the oven, due to faulty heating elements.

When the drying oven is not operational, Section 5.2 will be bypassed. Section 5.1 shall have step 11 replaced with the statement "Rinse with RO/DI water in appropriate reservoir." Step 11 will then become Step 12. Step 13 shall read "Allow equipment to air dry until all visible moisture has evaporated. Then continue with Section 5.3.

This process will only be performed if the oven in the 6268 cleaning facility is not operational.

[ ] One Time [X] Permanent

Justification

Due to the inability to keep the drying oven in the 6268 facility operational, this ICA allows equipment cleaning to continue, thus meeting our customers need. Air drying of cleaned equipment is an acceptable method in the equipment cleaning process, which is included in procedures that have been approved by the New Jersey Environmental Protection Agency.

Approvals: (Print/Sign Name and Date)

D. L. Edwards D L Edwards	4-1-96	R. A. Meznarich R.A. Meznarich	4-1-96
ICA Author	Date	ICA Author's Manager	Date
Same		WR Thackaberry	4-2-96
Instruction Author's Manager	Date	Quality Assurance (If Required)	Date
		N/R	
Other	Date	Safety (If Required)	Date

A-6000-370 (05/95) WEF158

1.0 PURPOSE

This Environmental Investigations Instruction (EII) establishes the method of cleaning equipment used for RCRA and CERCLA protocol sampling. The steps provided in this EII are intended to prevent cross-contamination of samples by contaminated sampling equipment.

2.0 SCOPE

This EII applies to the cleaning of equipment used for RCRA/CERCLA sampling before the equipment is taken into the field.

This procedure applies only to the personnel of Environmental Operations (Sampling Team) who have been indoctrinated in RCRA/CERCLA sampling and have been trained in the operation of this procedure.

3.0 REQUIREMENTS

3.1 Safety

1. Equipment cleaning presents the following hazards.

    a. Nitric acid (although diluted) may react with metallic objects and could produce toxic fumes. Nitric acid shall be stored in approved acid containment and shall be labeled properly.

    b. Hexane is a flammable liquid and could produce serious physical effects if inhaled or spilled on the skin. Hexane shall be stored in UL-approved containers and shall be labeled properly.

    c. A burn hazard is encountered if hot drying ovens are used.

    d. Lifting hazards and possible pinch points.

2. Use personal protective equipment (PPE) in accordance with WHC-CM-1-1, safety requirements, and laboratory-specific procedures.

3. When handling dangerous chemicals, wear proper PPE, such as appropriate gloves, safety glasses, lab coats, and face shields to protect your skin from burns.

4. Clean with dangerous chemicals only under a laboratory hood or in a properly ventilated area to prevent inhalation of dangerous fumes.

* This procedure has been rewritten, therefore, no revision bars were used to denote changes.

5. Exercise caution and wear proper PPE when working with equipment in a drying oven.

3.2 Equipment

1. At a minimum, the laboratory facility must have the following:

   a. Exhaust hood(s) to eliminate inhalation hazards.

   b. Drying ovens of sufficient size to accept a 24-inch-long drive barrel.

   c. A lockable storage area with controlled access to store cleaned equipment.

   d. Drains or containment facilities for hazardous chemical waste.

   e. Water system capable of providing ASTM D1193, "Standard Specifications for Reagent Water", Type I, II, or III. ASTM Type I, II, or III water is referenced as RO/DI water for the remainder of this procedure.

   f. Safety shower.

3.3 Equipment Receipt at the 6268 Facility

Equipment must be surveyed and unconditionally released from radiological controls before being transported to the 6268 cleaning station. All equipment shall be free of visible dirts, oils, and tape, prior to being accepted at 6268.

4.0 REPONSIBILITIES

The Environmental Operations (Sampling Team) is responsible for:

1. Conducting equipment cleaning activities.

2. Based on field conditions, equipment, material, and manpower availability, assigning personnel to transport contaminated equipment.

3. Tracking and maintaining an inventory of cleaned sample equipment.

The customer shall:

1. Ensure that all equipment brought into the cleaning station is new (off-the-shelf), has been free-released by the field RCT support for the job, or was never used inside a radiologically-zoned area.

2. Ensure that the proper charge code is provided when picking up equipment. Equipment will not be distributed without a charge code.

5.0 PROCEDURE

5.1 Cleaning

NOTE: Ensure that proper PPE is available and is worn during the cleaning process.

1. Prepare work area for cleaning.

2. Note numbered location of all reservoirs. All reservoirs (with the exception of the nitric rinse and the hexane rinse) shall be filled with RO/DI water.

3. Fill reservoirs 1, 2, 3, 4, 6, 7, and 8 (one at a time, in order) with RO/DI water to approximately 1/2 full capacity.

4. Place three scoops of dry phosphate-free detergent into reservoir 1.

5. Wash equipment in reservoir 1 to remove all visible dirt and grease with the phosphate-free detergent/water mixture.

6. Rinse equipment in reservoirs 2, 3, and 4 with RO/DI water.

NOTE: **When cleaning equipment other than stainless steel or glass, skip steps 7, 8, and 9.**

NOTE: **The 1M HNO_3 rinse does not need to be replaced for each cleaning cycle. Check the acidity of the rinse with pH paper to ensure a pH less than 2. Also visually check the rinse for cleanliness. If the pH is greater than 2 or the rinse appears dirty then replace the HNO_3 solution.**

7. Rinse with 1M or 10% solution of HNO_3 under the exhaust hood in reservoir 5.

8. Rinse equipment in reservoirs 6, 7, and 8 with RO/DI water.

   NOTE: **HEXANE IS CONSIDERED A FLAMMABLE MATERIAL.**

9. Allow the equipment to drain excess water prior to proceeding to the next step.

10. Rinse with chromatograph grade hexane under an exhaust hood in reservoir 9.

11. Place on the oven drying rack.

5.2 Oven Operation

****

CAUTION: Do not use the oven to dry equipment that may melt when subjected to temperatures of 100°C.

****

1. Place drying rack loaded with equipment into the drying oven.

2. Close door and lock door handle.

3. Place the Chamber Power switch to the "ON" position.

4. Check that the Oven Temperature Controls (2) are both set at 120° C.

5. Adjust the set point to 100° C by depressing the "↑" key on the control pad and holding it until the readout displays "100".

NOTE: The oven will purge for 10 minutes before the heating elements heat up.

NOTE: The oven will take approximately 50 minutes to reach the set point of 100° C.

6. Once the oven reaches the set point, allow the equipment to bake for 20 minutes.

7. Adjust the set point to 30° C by depressing the "↓" key on the control pad and holding it until the readout displays "30".

8. Once the oven temperature reaches 30° C, place the Chamber Power switch to the "OFF" position.

9. Open the door handle lock and open the door to the oven.

10. Remove the drying rack from the oven.

5.3 Equipment Wrapping/Storage

NOTE: When wrapping/handling equipment, wear surgeons gloves to reduce the potential for equipment contamination.

1. Enclose cool/dry equipment in clean, unused aluminum foil (shiny side out) or another clean, air-tight container that will not contaminate the equipment.

2. Seal the protective wrapping as needed with tape or similar sealant to maintain cleanliness.

3. Store wrapped equipment in a custody-locked, controlled-access area until needed.

5.4 Waste Accumulation/Disposal

All waste management activities for the handling of waste associated with the cleaning process are conducted in accordance with WHC-IP-1127, Section 5.7, "Satellite Accumulation Area Management at 6268 and 6269 Facilities."

NOTE: **DO NOT DISPOSE OF POTENTIALLY HAZARDOUS MATERIALS IN THE 6268 FACILITY DRAIN SYSTEM.**

1. Reservoirs 1, 2, 3, 4, 7, and 8 shall be collected and placed in a 55-gallon rinsate drum located on the spill pallets in the 6268 working area.

   a. The volume (%) added to the drum shall be entered into the specific drum inventory log.

NOTE: **When the drums located in the Satellite Accumulation Area (SAA) are approximately 2/3 full, notify the organizational Environmental Compliance Officer (ECO) to make arrangements for disposal of the waste materials.**

2. Reservoir 5 (when pH is greater than 2 or the rinsate looks dirty) and reservoir 6 shall be collected and placed in the nitric rinsate drum located in the SAA. The volume (%) added to the drum shall be entered into the specific drum inventory log.

NOTE: **If the contents of reservoir 5 are not dirty or the pH remains less than 2, leave the material in reservoir 5 and cover with the protective lid.**

3. Reservoir 9 shall be collected and poured into a separatory funnel under the exhaust hood. The hexane and water mixture shall be separated with the water being added to the hexane rinse drum located in the SAA. The volume (%) added to the drum shall be entered into the specific drum inventory log. The remaining hexane, if not visually contaminated shall be placed back into the original container and shall be stored in a flammable cabinet under the benchtop working area of the exhaust hood.

4. Cover each of the reservoirs with a lid once all waste materials have been removed.

5. Completed drum inventory log sheets shall be placed in the file cabinet located in the office area file cabinet in 6268. One log sheet is required per waste drum.

5.5 Equipment Check-out

1. When equipment is checked-out to customers, prepare the Equipment Check-Out form, A-6001-828, macro WEF301.

2. Provide a copy of the form to the customer and a retain a copy in the 6268 facility filing system.

5.6 Equipment Check-in

1. When equipment is dropped-off for cleaning at the 6268 cleaning facility, ensure that the customer completes the Equipment Check-In form, A-6001-829, macro WEF302.

2. Retain the form in the 6268 facility filing system.

6.0 DESIGNATED REVIEWING ORGANIZATION

The organization designated to review changes to this document is Hanford Technical Services, the process owner. Comments from other organizations are welcome, however, such comments are dispositioned at the option of the process owner.

7.0 REFERENCES

WHC-IP-1127, *Sampling and Mobile Laboratories Procedure Manual*, Section 5.7, "Satellite Accumulation Area Management at 6268 and 6269 Facilities."

ASTM D 1193, "Standard Specification for Reagent Water."

8.0 BIBLIOGRAPHY

Job Safety Analysis-3, "RCRA Sampler Decontamination."

WHC-CM-1-1, *Safety Manual.*

WHC-SD-CP-HSP-001, *Westinghouse Hanford Company Chemical Hygiene Plan.*

1.0 PURPOSE

This Environmental Investigations Instruction (EII) establishes controls for the receipt, storage, and removal of geotechnical samples within the Hanford Geotechnical Sample Library (HGSL). The HGSL consists of two facilities, one at the 2101M Building (referred to as 2101M) and one at *200-E, Hanford Technical Service's (HTS) Pipeyard.*

2.0 SCOPE

This EII applies to all nonhazardous and nonradioactive geotechnical samples collected in support of siting, construction, environmental, and/or waste management activities.

3.0 REQUIREMENTS

3.1 Security

Access to the 2101M facility and *HTS* Pipeyard is controlled by the file custodian. A sign-in book will be kept at each facility to record visitors' name, company, time in and out, date of visit, and reason for visit.

3.2 Safety

1. Personnel lifting core boxes or heavy sample containers (or any other heavy and/or unwieldy object) at the HGSL must wear protective toe shoes/boots.

2. Individuals performing sampling in the HGSL must wear safety glasses.

3. Personnel handling sample containers at the HGSL must check the integrity of each sample container and box of sample containers before lifting.

4. Two people are required for lifting sample containers that exceed 40 lbs.

3.3 Sample Control

1. Geotechnical samples shall be afforded archival controls and protection for the period during which additional examination or analysis by *Hanford Site contractors,* the U.S. Department of Energy (DOE), or authorized regulatory agencies (e.g., Nuclear Regulatory Commission [NRC], U.S. Environmental Protection Agency [EPA]) may be needed. Sample shelf lives and the disposition of destroyed or substantially changed samples are to be determined by cognizant technical personnel on a sample-by-sample basis in accordance with applicable work plans and procedures. No sample stored in the HGSL can be disposed of without written approval from the *HTS Manager or designee.*

2. The database is maintained current by the File Custodian to reflect any conditions or changes in characteristics or documentation for the geotechnical samples while in storage. Examples of conditions or changes to be reflected in the database include contamination of the sample or incorrect or inadequate documentation to the extent that the sample or data may not be useable for the intended purpose.

3. Individuals/organizations removing specimens shall ensure the return of subspecimens.

4. If any chemicals or other hazardous materials were added to the sample during testing, the testing organization shall dispose of the subspecimen.

3.4 Recording Entries

1. Every time a written entry (e.g., on a record form or specimen container) is required, personnel shall write legibly using permanent black ink.

4.0 PROCEDURE

4.1 Submitting Samples to the HGSL

Individuals/orgs collecting samples	1. Select, collect, identify, handle, package, store, and transport samples in accordance with applicable test documents, work plans and procedures.
	2. Perform and document all sampling activities in accordance with applicable procedures.
	3. Document all analyses performed on samples before submittal in the comments column of the Geotechnical Sample Transfer Record. Use the continuation page to list additional samples.
	4. Do not transport water samples to the HGSL and ensure that the sample jars contain less than 1/4 inch standing water.

5. Ensure that a radiation survey is performed on each sample container before submittal to HGSL and that the Health Physics Release block has been completed. The *Radiation Control Technician (RCT)* has the option of either signing, dating and entering the Radiological Survey Report number on the Geotechnical Sample Transfer Record or entering the Radiological Survey Report number and attaching a copy of the Radiological Survey Report.

   NOTE: **The Radiological Survey Report is required unless prior written exemption has been granted by the Occupational Health and Safety (OHS) organization.**

6. Mark or label the sample container with the Sample Container Label to identify their contents. To maintain traceability, all sample container lids will also be labeled with the following as a minimum:

   a. Sample identification number
   b. Printed initials of collector
   c. Date of collection
   d. Sample number.

7. Prepare and sign appropriate portions of the Geotechnical Sample Transfer Record.

8. Transport or schedule transport of samples to the HGSL and notify the File Custodian, whenever possible, 24 hours before each delivery.

4.2 Sample Receipt

File Custodian

1. Verify that the RCT Release block has been completed in accordance with Section 4.1, item 5.

   NOTE: **The Radiological Survey Report is required unless prior written exemption has been granted by the OHS organization.**

   a. If the Health Physics Release block has not been completed and no exemption is in effect, do not pick up or accept the samples and inform the geologist or point of contact immediately for action.

   b. If the block is complete, the File Custodian may pick up samples from lock boxes at each site and transport to the HGSL.

2. Sign and date the "Received By" block on the Geotechnical Sample Transfer Record verifying the following:

   a. All samples specified on the Geotechnical Sample Transfer Record have been received.

b. The "Initiated By" block on the Geotechnical Sample Transfer Record has been signed and dated by the geologist submitting the samples.

c. The Geotechnical Sample Transfer Record is legible, accurate, and complete.

3. Verify that all sample containers are marked or labeled with the Sample Container Label to identify their contents. To maintain traceability, all sample container lids will also be labeled with the following as a minimum:

   a. Sample identification number
   b. Printed name of collector
   c. Date of collection
   d. Sample number.

4. Do not accept any sample container not properly marked. Contact the geologist who submitted the sample, obtain the missing information, add that information to the label on the sample container and on the lid, then initial and date all added information.

4.3 Storing Samples

File Custodian

1. Place the samples and/or their storage containers in a permanent storage location within the HGSL.

2. *Place the core samples in the designated area at the 200 East Pipeyard. Place the samples on a cement pad and cover with plywood to provide protection from the weather.*

3. Enter the storage location of the samples, specimens, and/or subspecimens and any other pertinent information into the computerized data retrieval system.

4. Provide annual database reports of core/sediment sampling activity to the Manager, Well Services.

5. Should an event occur in the HGSL that could adversely impact sample analysis results (e.g., dropping and mixing of sample contents), notify the Manager of *Well Services* in writing and update the database to reflect current sample conditions.

4.4 Sampling and Controlling Geotechnical Samples

4.4.1 Initiation of sampling at HGSL

Sampling Personnel

1. Inspect geotechnical samples in a manner that does not alter the physical or chemical properties/integrity of the sample. If examination requires that a sam ple be removed from its container, the sample must be replaced in the same orientation as removed. No special equipment is necessary to examine samples, specimens, or subspecimens.

2. Before removing any specimens, obtain approval from the Manager, *Well Services* or designated individual, on a Geotechnical Sampling Record.

3. Notify the File Custodian of the intent to examine samples, specimens, or subspecimens; establish a time to obtain specimens or subspecimens at the HGSL.

4. Complete the Geotechnical Sampling Record, verifying/documenting the selection, removal, and identification of specimens from the HGSL.

5. Ensure that subspecimens are returned to the HGSL following analysis if there is any material remaining after analysis (using the Geotechnical Sample Transfer Record). If any chemicals or other hazardous materials were added to the sam ple during the testing, the testing organization disposes of the subspecimen.

6. Ensure that data resulting from the analysis of a specimen is traceable to the sample/specimen from which it was obtained.

7. Complete the following portions of the Geotechnical Sampling Record:

   - Type of Geotechnical Specimen. If more than one type of geotechnical specimen is removed, enter the specimen types in each block of the "Comments" column.

8. Submit the completed Geotechnical Sampling Record to the File Custodian.

File Custodian

9. Assign a consecutive notebook number to the Geotechnical Sampling Record, sign and date in the HGSL Release Block.

4.4.2 Sampling core

Sampling Personnel

1. As the specimens are being removed, record the following information on the Geotechnical Sampling Record:

   a. Record the designation of the borehole from which the specimens are derived in the "Borehole Designation/Sample No." column.

b. Record the number of the core box containing the interval approved for sampling in the "Box No." column.

c. Record the beginning and ending footage of the specimen interval in the "Specimen Interval" column. Obtain beginning and ending footage of all specimen intervals by measuring the distance from the previous core box block (+ 0.1 foot) used to identify the beginning of a drill run. If footage stickers have been applied previously to the core, they are used to obtain sampling interval footage.

d. Enter N/A (Not Applicable) in the "Quantity Removed" column.

e. Enter the type(s) of test(s) to be performed on the specimen in the "Test Type" and/or comments column.

2. Assign a unique identification number to each specimen that is traceable to the original sample. (Example: In the identification number DH4-3325-X, DH4-3325 is the original sample number, and "X" is the number assigned to the specimen.) Give sequential numbers to subsequent specimens for that sample. Write this number on the specimen and/or the shipping container (e.g., sample bag) and record on the Geotechnical Sampling Record in the "Borehole Designation/Sample No." column.

3. Replace the specimens from the core boxes with cardboard tube or other spacers cut to the approximate length of the specimen. Record the following information on the spacer:

   a. Beginning and ending footage of the specimen interval.

   b. The unique sample number assigned by the sampler.

   c. The sampler's initials.

   d. The date the sampling was performed.

4. Mark the appropriate core photographic overlays, if available, to show which pieces or sections of core are removed. Use brackets to indicate sampled intervals, with an "S" for sample.

   NOTE: **The core photographs are of cores from the BWIP. This part of the instruction may be omitted for cores without photographs.**

5. Establish and mark archival samples on the core photos.

   NOTE: The archival interval is a split of the core removed. This split should be a vertical section of the core (not just an end or partial section); however, certain tests may require a full core. If a vertical split is inappropriate, a section of the core adjace nt to the specimen shall be substituted. The archival core section is to be marked with permanent ink using an "A" and is not to be removed from the core box at any future date. The archival interval shall be marked on the core photographs as an "A" with brackets showing the archival interval. A specimen of the archival sample may be taken upon written permission from the Manager, *Well Services* or designated individual. In that event, a copy of the letter shall be attached to the sampling record, and an alternate archival interval shall be chosen.

4.4.3 Sampling drill cuttings

Sampling Personnel

1. As each specimen is being removed, record the following information on a Geotechnical Sampling Record:

   a. Record the designation of the borehole from which the specimen was derived in the "Borehole Designation/Sample No." column.

   b. Enter N/A (Not Applicable) in the "Box No." column.

   c. Record the beginning and ending footage of the specimen interval (as read from the container from which the specimens were removed) in the "Specimen Interval" column.

   d. Enter the type(s) of test(s) to be performed on the specimen in the "Test Type" and/or comments column.

2. Assign a unique identification number to each specimen that is traceable to the original sample. (Example: In the identification number DH4-3325-X, DH4-3325 is the original sample number, and "X" is the number assigned to the specimen.) Give sequential numbers to subsequent specimens for that sample. Write this number on the specimen container.

3. Keep a portion of the drill cuttings (at least one-half of the original sample) in the container for archival purposes.

4.4.4 Sampling grab samples/subspecimens

Sampling Personnel

1. As each specimen is being removed, record the following information for each specimen on the Geotechnical Sampling Record:

a. Record the grab sample number in the "Borehole Designation/Sample No." column.

b. Enter N/A (Not Applicable) in the "Box Number" and "Specimen Interval" column.

c. Enter the type(s) of test(s) to be performed on the specimen in the "Test Type" and/or comments column.

d. Enter the project number or title that the specimen was taken for in the comment column.

2. Assign a unique identification number to each specimen that is traceable to the original grab sample. (Example: In identification number SR891-X, SR891 is the original grab sample number, and "X" is the number assigned to the specimen.) Give sequential numbers to subsequent specimens for that sample. Write this number on the specimen and/or the shipping container.

3. Replace the specimen in the container from which it was removed; record the following information:

   a. Specimen number.

   b. Number of the Geotechnical Sampling Record used to document removal of the specimen.

4.4.5 Completion of sampling

Before removing specimens from the HGSL, perform the following:

Sampling Personnel

1. Sign and date the "Sampled By" block on the Geotechnical Sampling Record.

File Custodian

2. Sign and date the "Authorized By" block on the Geotechnical Sampling Record and verify the following:

   a. That intervals/amounts of samples removed as specimens were identified on the Geotechnical Sampling Record in the containers from which they were removed.

   b. That specimens and/or their shipping containers were identified.

   c. That the Geotechnical Sampling Record is legible and complete.

5.0 RECORDS

Record processing and disposition is in accordance with the following table.

Name, File Unit Title or Description	**Record Type***	**Retention Period**	**Disposal Authority**	**Cut-off and Retirement Instructions**
Database file and other relevant information	R	TBD	GRS 23.3	Delete information in databases when no longer needed.
Geotechnical Sample Transfer and Sampling forms	R	TBD	TBD	May be destroyed when data entry and verification are complete and shall be reviewed annually in accordance with approved RIDS.
Core photographs	R	TBD	TBD	Stored in a locked cabinet.
Visitor sign-in book/sheets	N/R	Nonrecord	Nonrecord	Destroy when no longer useful.

* R = Record N/R = Nonrecord TBD = To be determined

6.0 DESIGNATED REVIEWING ORGANIZATION

The organization designated to review changes to this document is Hanford Technical Services, the process owner. Comments from other organizations are welcome, however, such comments are dispositioned at the option of the HTS organization.

7.0 FORMS

Geotechnical Sample Transfer Record (BC-6000-291)

Geotechnical Sample Transfer Record Continuation Page (BC-6000-286)

Geotechnical Sampling Record (BC-6000-284)

Geotechnical Sampling Record Continuation Page (BC-6000-285)

Sample Container Label (BL-6000-610)

8.0 REFERENCES

Not applicable.

INSTRUCTION CHANGE AUTHORIZATION

ICA No. 095

Instruction (EII) No.	Rev. No.	
WHC-CM-7-7, EII 5.8, Groundwater Sampling	3	Page 1 of 1

Description of Change — Approval Designator Q

Dependent on program needs, a modified version of the PNL Groundwater Sample Field Record form may be used in lieu of the Ground Water Sample Report, form A-6000-480. In addition, a modified PNL Chain of Custody/Sample Analysis Order (Request), BD-1200-345(7/94) may be used in lieu of the COC/SAR form specified in EII 5.1.

[X] One Time [] Permanent

Justification

Scheduling RCRA/Operational groundwater samples via HEIS does not currently accommodate WHC forms. As soon HEIS is modified to load the WHC forms, this ICA will be canceled and the WHC forms will be used.

No data elements are missed by using the modified PNL forms.

Approvals: (Print/Sign Name and Date)

D. M. Day Debra M. Day	3-22-95	D. G. Horton D.G. Horton	3/22/95
ICA Author	Date	ICA Author's Manager	Date
D. G. Horton D.G. Horton	3/22/95	W. R. Thackaberry W.R. Thackaberry /telecon	3-22-95
EII Author's Manager	Date	Quality Assurance (If Required)	Date
N/A		N/R	
Other	Date	Safety (If Required)	Date

A-6000-370 (02/94) WEF158

INSTRUCTION CHANGE AUTHORIZATION		ICA No. 096
Instruction (EII) No. EII 5.8, Groundwater Sampling	Rev. No. 4	Page 1 of 1

Description of Change

Approval Designator Q

The Chain of Custody/Sample Analysis Request form A-6001-500 (7/95) may be used instead of COC forms listed in this procedure. This form is currently being set up for use on Siteforms. This format will replace the existing format of COC/SAR form BC-6000-828.

[X] One Time [] Permanent

Justification

The 7/95 version of form A-6001-500 fulfills the needs of other facilities such as 222-S while maintaining the COC and SAR requirements.

Approvals: (Print/Sign Name and Date)

D. M. Day	8-21-95	D. G. Horton	8/21/95
ICA Author	Date	ICA Author's Manager	Date
D. G. Horton	8/21/95	W. R. Thackaberry	8.21.95
EII Author's Manager	Date	Quality Assurance (If Required)	Date
N/R		N/R	
Other	Date	Safety (If Required)	Date

INSTRUCTION CHANGE AUTHORIZATION (ICA)

ICA No. 097

Instruction No.	Rev. No.	
EII 5.8, Groundwater Sampling	4	Page 1 of 1

Description of Change

Approval Designator Q

The QED Purge Saver will be tested and used for groundwater sampling. The instrument contains all the necessary indicator parameters (pH, conductivity, and temperature) for sampling. Operation and calibration shall follow the Purge Saver user's guide.

This will be tested for the first quarter of the operational program.

[X] One Time [] Permanent

Justification

The Purge Saver contains a flow through cell that will be tested for reduced purge volumes, comparability, and accuracy of field parameters. The information from the Purge Saver can be stored on a datalogger to be downloaded into a computer. Increased efficiency, reliable field parameters, and additional supplemental stability indicators (DO and ORP) will be a result of using the Purge Saver. A revision to the procedure will be made depending on the results of tests.

Approvals: (Print/Sign Name and Date)

K. F. DONNELSON	10-31-95	D. G. HORTON	
ICA Author	Date	ICA Author's Manager	Date
D. G. HORTON		W.R. THACKABERRY 11-2-95	11/1/95
Instruction Author's Manager	Date	Quality Assurance (If Required)	Date
N/R		N/R	
Other	Date	Safety (If Required)	Date

A-6000-370 (05/95) WEF158

INSTRUCTION CHANGE AUTHORIZATION (ICA)		ICA No. 099
Instruction No. WHC-CM-7-7, Sec. EII 5.8, "Groundwater Sampling"	Rev. No. 4	Page 1 of 1

Description of Change

Approval Designator Q

Add to Appendix A, Section 2.0, new item 44:

Field Sampling Information System (FSIS)

Add to Appendix A, Section 4.0:

The FSIS will be used to log in field data. A Groundwater Sample Report (GWSR) will be printed from this data. In the event FSIS is inoperable, use GWSR provided with chain-of-custody sheets for data collection.

[] One Time [X] Permanent

Justification

FSIS is in operational mode. The computerized system is used to eliminate transcribed errors and to take field personnel through groundwater sampling procedures.

Approvals: (Print/Sign Name and Date)

K. F. Donnelson Karl F. Donnelson	12-1-95	D. G. Horton D G Horton	12/1/95
ICA Author	Date	ICA Author's Manager	Date
D G Horton	12/1/95	W. R. Thackaberry WR Thackaberry	12-1-95
Instruction Author's Manager	Date	Quality Assurance (If Required)	Date
		N/R	
Other	Date	Safety (If Required)	Date

A-6000-370 (05/95) WEF158

1.0 PURPOSE

The purpose of this Environmental Investigations Instruction (EII) is to provide general requirements and guidance for performing groundwater sampling.

2.0 SCOPE

This EII applies to groundwater sampling performed at the Hanford Site as specified by contract documents. This EII is limited to technical sampling activities in which groundwater samples are submitted for chemical or radiological analysis. Site-specific groundwater sampling requirements are provided in individual sampling and analysis plans or groundwater monitoring plans (WAC 173-303). Appendices A through H of this EII describe individual sampling methods or techniques.

3.0 REQUIREMENTS

3.1 Safety Requirements

1. Sampling activities shall comply with the applicable safety document, HWOP, or Job Hazard Analysis (JHA) requirements for access control, monitoring of radiation and environmental hazards, and personal protective equipment.

2. General safe working requirements described in Appendix A will be observed on all groundwater sampling sites.

3. In any groundwater sampling operation occurring within surface contamination areas, radiological materials generated will be handled, stored, and disposed of in accordance with applicable health physics requirements.

4.0 PROCEDURE

4.1 Before Sampling Operations Begin

Management

1. Assign qualified personnel to projects.

Cog Engineer

2. Designate personnel responsibilities (may vary depending on the magnitude of the sampling operation and method employed).

3. Before initiating any field sampling activities, meet with all field sampling personnel to review all safety precautions and radiation and health and safety monitoring requirements; document this meeting in the field logbook.

4. Review the general scope of sampling operations with groundwater sampling personnel.

   NOTE: Sample types, sampling techniques to be used, and well locations are described in the sampling and analysis plan or the groundwater monitoring plan. The Quality Assurance/Quality Control Plan provides requirements for the frequency of, and specific definitions for, the use of splits, field blanks, method blanks, spikes, duplicates, or other quality control samples.

5. Ensure that proper decontamination equipment is present onsite for the removal of expected contaminants. Expected contaminants are discussed in the JHA and the sampling and analysis plan or groundwater monitoring plan.

6. Ensure that only decontaminated and/or clean sampling equipment are used unless dedicated manifolds are present. Requirements for sampling are discussed in the appropriate Groundwater Monitoring Plan.

4.1.1 Bottle Preparation

FTL/CE (or designee)

1. Ensure that appropriate prepared containers are available for the collection of groundwater samples.

2. Do not use containers that have missing preparation codes or damaged seals or that are otherwise suspect; discard them or return them to the decontamination facility.

   NOTE: Container preparation requirements such as proper preservative and recommended containers are identified in the site-specific sampling and analysis plan or groundwater monitoring plan. Ensure that extra containers are available to accommodate additional sampling (e.g., for quality control samples), breakage, or loss.

3. Keep the following supplies available:

   a. Sample containers
   b. Sample seals or evidence tape
   c. Labels
   d. Bottles/caps
   e. Cold packs or ice (as required by the sampling and analysis plan)
   f. Coolers
   g. Shielded boxes (as required)
   h. Absorbent packing material (as required)
   i. Other items (as required).

FTL/CE (or designee

4. Ensure that sample containers being used are certified clean prior to use.

4.2 During Sampling Operations

FTL

1. After all pre-sampling requirements have been met and documented in the field logbook, authorize the start of (and direct) sampling operations and coordinate onsite support activities.

2. Use Appendix A through H of this EII for individual sampling methods or techniques as listed below:

   - Appendix A, "General Sample Collection Procedure."
   - Appendix B, Sample Collection using the Submersible Pump."
   - Appendix C, "Sample Collection Using the Hydrostar[1] Pump."
   - Appendix D, "Sample Collection Using a Bladder Pump."
   - Appendix E, "Sample Collection using a Teflon[2] Bailer."
   - Appendix F, "Sample Collection from a Piezometer Using the Air Lift Method."
   - Appendix G, "Sample Collection from a Piezometer Using the Bailing Method."
   - Appendix H, "Sample Collection from a Well Using a Wa Terra Pump."

3. Ensure that measures are taken to prevent leaks or spills.

Sampler

4. Ensure that proper sample containers are used.

5. Before collecting the groundwater samples, ensure the sample containers have chemical preservatives as listed in the sampling and analysis plan or the groundwater monitoring plan.

   NOTE: The appendices to this procedure and either the sampling and analysis plan or the groundwater monitoring plan discuss special considerations to be followed for volatile organic constituent testing when appropriate to the sampling method.

6. Record and document sampling operations in the field logbook and on the Groundwater Sample Report with special emphasis on odd or unusual appearances or occurrences (such as immiscible liquids, strange odors or colors, unusual equipment malfunctions, anomalously high or low water levels, and other problems that may impact sample quality).

7. Perform minor well head maintenance.

HPT

8. Monitor personnel and equipment for radiation.

4.2.1 Decontamination facilities/purgewater containment

[1]Hydrostar Instrumentation Northwest, Inc., Redmond, WA
[2]Teflon is a trademark of the E.I. duPont de Nemours and Company.

FTL/CE

1. Ensure proper cleaning and decontamination of sampling equipment. Follow the guidance given in EII 5.5.

Sampler

2. Perform nonradiological chemical field decontamination of sampling equipment at the direction of the FTL/CE.

FTL/CE

3. Ensure proper containment of wash water that results from decontamination activities; document in the logbook.

4. Ensure that the purgewater from the well is contained or disposed of as required by EII 10.3. Document all containment/disposal of wash water and purgewater in the field logbook.

4.2.2 Nonroutine release response

FTL/CE

1. Contain, arrange analysis for, and dispose of leaks or spills, as appropriate.

   NOTE: It is the responsibility of any employee to report nonroutine releases (spills, leaks) of purgewater. The appropriate response to nonroutine releases is specified in WHC-CM-7-5, Section 5.0. Section 5.0 specifies actions for accidental spills of hazardous/dangerous waste, regulated substances (WHC-CM-7-5 or 40 CFR 302.4), and oil or petroleum products. The responsibilities of WHC Environmental Compliance Support include collecting pertinent information on the release, making a preliminary assessment of environmental damage, and reporting the release to appropriate support groups such as the Emergency Duty Officer; Facility Manager; Health Physics; Industrial Health, Safety, and Fire Protection; and Solid Waste Engineering. Spills/leaks that are not classified as nonroutine releases shall be contained, analyzed, and disposed of in accordance with EII 4.2 of this manual.

4.2.3 Decontamination

FTL/CE

1. Ensure that decontamination is performed in accordance with EII 5.5 of this manual, unless a more appropriate method of decontamination, specific to the needs of the project, is identified in the sampling and analysis plan or the groundwater monitoring plan.

2. When the containers are purchased commercially they must be certified clean upon arrival.

4.3 After Collecting Samples

Sampler

1. Preserve water samples by placing the sample container on ice to retard degradation/alteration of the sample.

2. Immediately seal and label the sampling container (store the sample in the required cooler, shipping container, or shielded container).

3. As directed by the FTL/CE, prepare a Chain of Custody/Sample Analysis Request (COC/SAR) (BC-6000-828, Siteforms) or Chain of Custody (A-6000-407, macro WEF061) and Sample Analysis Request (A-6000-406, WEF060), and appropriate shipping documentation.

   NOTE: In accordance with EII 5.1, a COC/SAR accompanies the samples to the laboratory.

Sampler

4. Transmit copies of the chain of custody, shipping, and radiation documentation to Analytical Services (AS) *and/or PNL* by close of business the working day after sample shipment.

5. Make a copy available to all other data users within ten working days of the sample date.

FTL/CE

6. Ensure that sample identification numbers are in accordance with EII 5.10 of this manual.

7. Record sample identification numbers in the field logbook; detail included on the chain of custody documentation need not be repeated in the field logbook.

8. Coordinate sample shipment.

   NOTE: When groundwater samples are shipped offsite, they are packaged and shipped in accordance with EII 5.11 of this manual. Coordinate shipping with the WHC Transportation Logistics and Shipping/Receiving organizations and Analytical Services.

4.4 Records

Records generated during field sampling activities are processed and dispositioned in accordance with the following table.

Name Filing Unit Title or Description	**Record Type***	**Retention Period**	**Disposal Authority**	**Cut-off and Retirement Instructions**
Field Logbook(s)	QA	TPA + 10 years	DRS 1.8c (force fit)	Submit weekly copies to FC; submit completed logbook to FC upon project completion or when no longer needed, for transmittal to IRM permanent storage
Groundwater Sample Report(s)	QA	TPA + 10 years	DRS 1.8f (force fit)	Upon completion submit to FC for transmittal to IRM permanent storage
Chain of Custody/Sample Analysis Request	QA	TPA + 10 years	TBD	Transmit field completed chain of custody documentation to AS in accordance with EII 5.1. AS ensures that a copy of the completed form(s) accompany the sample analytical data package(s) received from the laboratory.

* QA = Quality Assurance; TPA = Tri-Party Agreement; TBD = To be determined

5.0 FORMS

Chain of Custody/Sample Analysis Request, form BD-6000-828, Siteforms
Groundwater Sample Report(s), form A-6000-408, macro GEF075
Chain of Custody, form A-6000-407, macro WEF061
Sample Analysis Request, form A-6000-407, macro WEF060.

6.0 DESIGNATED REVIEWING ORGANIZATION

The organization designated to review changes to this document is listed below. Comments from other reviewers are welcome, but are resolved at the originating organization's option.

Designated Reviewing Organization	CMPOC
Hanford Technical Services, process owner	PSS/HTS

7.0 REFERENCES

40 CFR 302.4, "Designation of Hazardous Substances."

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells."

WAC 173-303, "Dangerous Waste Regulations."

WHC-CM-7-5, *Environmental Compliance*, Section 5.0, "Records, Reporting and Response Activities."

WHC-CM-7-8, *Environmental Engineering and Geotechnology Function Procedures*, Volume 4,
Section 2.5, "Temperature Control of Groundwater Sample Storage Refrigerators."
Section 5.1, "User Calibration of Groundwater M&TE."

WHC-IP-0718, *Health Physics Procedures.*

8.0 BIBLIOGRAPHY

PNL-6907, *Hanford Wells.*

PNL-MA-567, *Procedures for Groundwater Investigations.*

APPENDIX A, GENERAL SAMPLE COLLECTION PROCEDURE

1.0 APPLICABILITY

This appendix specifies general procedures to be followed when collecting any groundwater sample.

2.0 SAMPLE EQUIPMENT REQUIREMENTS

The following is a list of equipment that may be needed to perform groundwater sampling (specific requirements are given in Appendices B through H):

1. Decontaminated sampling manifolds (1 per well)
2. In-line .45 μm filters (minimum 1 per well)
3. Low-submergence adapter for bladder pump
4. Small vacuum pump
5. Air compressor (equipped with dryer) and generator
6. Bladder-pump controller box
7. Bladder-pump hoses (set of two)
8. Extra discharge line for bladder pump
9. Hydrostar pneumatic cylinder
10. Hydrostar discharge hose
11. Extra discharge line for submersible pump
12. Two bailers
13. Two pH and conductivity meters
14. Two digital thermometers
15. Two steel measuring tapes
16. Carpenter's chalk
17. Large plastic bags
18. Electrical tape
19. Engineer's measuring tape
20. A map showing well locations
21. Stopwatch or watch with second hand
22. Bucket (for measuring flow rate)
23. Distilled water
24. Plastic bags
25. Ice chest(s) with ice
26. Plastic gloves
27. Disposable surgical gloves
28. Aprons
29. Towels
30. Indelible marker (noncontaminating to volatile organic analysis)
31. Extra sample labels
32. Evidence tape
33. Copies of relevant procedures
34. Sample containers with caps and liners (including extras)

35. Box of extra bottles
36. Groundwater Sample Report (A-6000-480)
37. Field logbook
38. Chain of Custody forms
39. Rubber gauntlet gloves
40. Radiation work protection clothes
41. Radiation detection instruments
42. Pencils and waterproof markers
43. Masking tape.

3.0 GENERAL PREPARATION AND SAMPLING PRECAUTIONS

FTL/CE

1. Before leaving for the field, calibrate field equipment (pH/conductivity meter and turbidity meter) using the manufacturer's recommended procedures and in accordance with Section 5.1 of WHC-CM-7-8, Vol 4.

2. Load the truck in a secure and safe manner with the necessary supplies. Test start generators, compressors, and other equipment before entering a zone.

All Personnel

3. Do not sample downwind from sources of volatile organics (e.g., car or generator exhausts, open fuel tanks). These could contaminate the sample. If any such sources are unavoidable, note them on the Groundwater Sample Report (A-6000-480).

Sampler

4. Leave caps on the sample containers until just before filling. Complete and apply sample labels to the sample containers. Figure A-1 illustrates a typical sample label and provides an explanation key.

All Personnel

5. Avoid handling the Teflon bottle cap liners. Do not use any liner that falls out of the cap and onto the ground.

6. Never allow the sampling flow rate to exceed the flow rate used while purging a well.

    a. A purge volume equivalent to three casing volumes is precalculated for each well and is entered on the Groundwater Sample Report. Some wells are low-yielding and will purge dry before three casing volumes are removed. Specific directions on how to collect a sample from these wells are in the appropriate sampling methods in Appendix B through H. If, during a well purge, the sampler detects the sound of cascading water (formation water vigorously reentering the well), turn off the pump and contact the FTL to determine the best method of collecting the sample without causing potential loss of volatile organics. Some wells require special pumping rates and will be noted on the Groundwater Sample Report.

b. Take necessary steps to prevent sampling equipment that will be handled immediately above the well head from coming into contact with the ground. Spread clean plastic on the ground, and place the sampling equipment on it, if necessary, during sampling setup operations and actual sampling.

c. Never leave measurement probes (such as pH, conductivity, and temperature), in contact with sample water upstream from the sample manifold when sample bottles are being collected. In addition, never place measurement probes in shipping containers containing groundwater samples for laboratory analysis.

4.0 GENERAL WORK PROCEDURES FOR GROUNDWATER SAMPLING

All Personnel

1. Read and become familiar with any and all applicable site safety documents (HWOP or JHA).

2. Attend all scheduled safety briefings. Document any necessary changes in safety procedures using EII 2.1 of this manual.

3. Park the vehicle near the well for convenience and safe operation of sampling equipment.

   NOTE: <u>Park downwind of the well being sampled</u> to prevent vehicle exhaust gases from affecting sample integrity.

FTL/CE

4. Immediately establish a temporary control zone around the well during purging and sampling activities, as necessary, to control visitor or unauthorized personnel access. Use visual references or (preferably) cones.

   NOTE: No eating, smoking or drinking is allowed in the control zone. All visitors must be kept out of the control zone and challenged for their legitimate need for access, level of hazardous waste training, level of protective clothing, and purpose for being there.

All Personnel

5. Wear personal protective clothing as defined in the site-specific safety document(s) to enter the control zone.

6. Avoid direct contact with the water except with gloved hands.

7. If splashed, wipe coveralls off with paper towels and discard the towel into the appropriate waste container.

8. If necessary, decontaminate using an eyewash station, and/or remove and discard coveralls and other protective apparel.

9. Avoid handling any objects not necessary for performing sampling procedures.

10. Remove gloves and discard into waste container or decontaminate (when appropriate) when sampling is complete and the chance of being splashed has ceased.

11. If required by WHC-IP-0718, monitor each sample for radioactivity and handle it as if it were contaminated (avoid excessive contact).

12. Wash hands after leaving the control zone and before eating, smoking, or drinking.

13. After the chance of being splashed has ceased, and when appropriate, remove the control zone.

14. When leaving the well site, avoid driving through the purge water puddles, if possible.

5.0 INSTRUCTIONS FOR COLLECTING ANY GROUNDWATER SAMPLE

FTL/CE

1. Select the appropriate sampling method by:

   a. Determining whether the borehole to be sampled is a well or a piezometer (by comparing diameter).

   b. Determining which pump is in the well, if any (submersible pump, bladder pump, Hydrostar pump, or no pump [requires use of a bailer]).

      NOTE: This information can be found on the Groundwater Sample Report. The appropriate method can be found in Appendices B through H. Follow the appropriate method first; then continue with section 5.0, step 2 of this appendix.

      NOTE: Operate pumps in a continuous manner so that they do not produce pulsating samples.

Sampler

2. Check for HPT coverage, total activity requirements, purgewater and purge truck requirements.

3. Measure depth to water.

4. *Recheck calibration of pH and conductivity using Section 5.1, "User Calibration of Groundwater M&TE," of WHC-CM-7-8, Volume 4.*

5. Take field readings:

   a. Ph, conductivity, and temperature are taken at the start, middle, and end of recommended purge and/*or* until stable.

   b. Two turbidity readings are measured before sampling.

6. Take other measurements *specified by the project scientist or cognizant engineer.*

7. Fill sample containers in the following order unless otherwise specified:

   1. Volatile organics
   2. Total organic halogens (TOX)
   3. Total organic carbon (TOC)
   4. Semivolatile organics
   5. Other unfiltered samples
   6. Filtered samples.

   NOTE: If the sampling order is different than that specified above, record the sampling order and justification for the order in the field logbook or on the Groundwater Sample Report.

8. Unscrew the cap from the sample container, being careful not to touch the lip of the bottle or the inside of the Teflon liner.

9. Fill the sample bottle slowly by placing the inner side of the sample bottle near the sampling manifold drop leg to prevent trapping any air bubbles. Avoid splashing or agitating the water while the bottle is being filled.

10. For those bottles requiring zero headspace (those having a septum lid), reduce the pumping rate to 100 mL/min (when possible). Check this rate in the field by timing the filling of a graduated cylinder/bottle.

    a. Fill each sample bottle completely so that a meniscus forms over the mouth.

    b. Cap the bottle immediately, turn it upside down, tap it a few times, and check for air bubbles in the sample.

    c. If a bubble exists, discard the sample and repeat the sampling procedures until a bubble-free sample is obtained.

    d. If the bottle to be filled contains a preservative, only make one attempt to obtain a bubble-free sample with that bottle.

11. On all other sample containers, fill the bottles as much as possible, and do not be concerned about bubbles.

Sampler

12. When a sample bottle is full, place it into a cooler that contains ice. After filling all bottle sets for one well, immediately (after survey, when required) attach evidence tape across each bottle top and return each bottle to the cooler. Be sure ice is distributed evenly in the cooler.

    NOTE: Sample collection in a radiation zone may preclude icing the samples until after the samplers have exited the zone. The FTL will determine when this exception is applicable.

13. Immediately after collecting the last sample bottle, measure the pH, temperature, and specific conductivity once and record on the Groundwater Sample Report.

14. Turn off any air compressor or bottled air used during the sampling operation.

15. Turn off the power switch of any generator. Turn the generator off, and unplug its power cord.

Sampler

16. Rinse sampling equipment (e.g., E-tapes) and probe with deionized (DI) water after every well.

17. Complete the Chain of Custody/Sample Analysis Request and the Groundwater Sample Report. The completed form shall accompany the samples at all times.

18. Place the samples in a secure location during transportation.

FTL/CE

19. Deliver the sample to the shipping personnel or the appropriate laboratory for analysis as soon as possible.

20. Have the person receiving the sample sign the Chain of Custody in accordance with EII 5.11 of this manual.

21. If the sample cannot be delivered the same day, store it in the sample shipping facility.

5.1 General Requirements For Sample Storage In Refrigerators

The refrigerators must be able to maintain a temperature in the range of 2° to 6° C (35.5° to 43.0° F). Methods of controlling refrigerator temperature are discussed in WHC-CM-7-8, Volume 4, Section 2.5.

NOTE: DO NOT freeze sample bottles.

5.2 General Requirements For Filtered Samples

The following technique shall be employed when the sampling and analysis plan or groundwater monitoring plan specifies that samples should be filtered.

5.2.1 Equipment

1. Filters (.45 μm in-line models)
2. 500-mL container (as necessary)
3. Filter adapter
4. Groundwater Sample Report (A-6000-480) specifying sample volume.

5.2.2 Instructions

Sampler

1. Prepare the well for groundwater sampling using the appropriate pump. (See Appendix B, C, or D.)

2. Attach filter to manifold filter assembly.

3. Wash 500 mL through the filter and discard wash water.

4. Fill sample bottles as specified on the Groundwater Sample Report.

5. One filter should be sufficient to collect the required sample volume under normal conditions.

   a. If a second filter is required, repeat the filter wash procedure described in the applicable appendix.

   b. If the filters clog too quickly, replace the standard filter with the high-capacity model, and repeat preparation.

Figure A-1. Typical Sample Labels.

SAMPLE LABEL

Collector: ____________________
Sample No: ____________________
Date Sampled: _________ Time: ____
Place Collected: ________________
____
Field Information:

SAMPLE LABEL COMPLETION INSTRUCTIONS

1. Name of sampler
2. Sample ID
3. Date sample collected
4. Time sample collected
5. Sample area
6. Pertinent field information that reflects any special field conditions existing at the time of sample collection.

SAMPLE LABEL

COC_______ Sample _______ Constituents:______

Preservative:
Lab:
Bottle Size:
Scheduled date:
Date/Time:
Collector:

SAMPLE LABEL COMPLETION INSTRUCTIONS

1. COC number
2. Sample ID
3. Constituent
4. Type of preservative
5. Laboratory
6. Bottle size and type
7. Scheduled date
8. Date and time sampled
9. Name of sampler.

APPENDIX B, SAMPLE COLLECTION USING THE SUBMERSIBLE PUMP

1.0 COLLECTING A SAMPLE FROM A WELL THAT CONTAINS A SUBMERSIBLE PUMP

Sampler

1. On arrival at the well head, remove the locking and protective cap.

2. Immediately determine depth-to-water with an electric measurement tape (e-tape) and record the determined value, estimated to the nearest 0.01 foot, on the Groundwater Sample Report or in the field logbook, as required by sampling program protocol.

   a. Perform a visual check for immiscible hydrocarbons such as gasoline and diesel floating on the surface in the borehole.

   b. Observe the end of the tape and record in the field logbook the presence of any greasy, film-like coating or detectable odor.

   NOTE: In situ detectors are currently under evaluation for this purpose. As they become available for general use, these devices will supplement or replace visual checks.

3. Attach manifold and purge hose to well.

4. Plug the power cord into one of the 230-V outlets on the generator on the truck and into the outlet at the well head.

5. Start the electric generator.

6. Turn the power switch ON to begin the pumping process. Do not handle energized power cords. If the pump does not work properly, as indicated by a lack of air flow out the discharge hose or by generator "lug" down, turn the switch OFF immediately. Perform the following steps:

   a. Wait a few seconds, then turn the switch ON and OFF several times rapidly, finally pausing in the ON position to determine if the pump has started to function properly.

   b. Repeat this several times.

   c. If the sample pump still doesn't work, it needs repair, submit a Well Services Request (WSR), form BC-6000-316.

   d. If the breakers or fuses on the generator disengage, an electrical short in the system exists, and repair is needed, submit a WSR.

   e. Record problems on the Groundwater Sample Report (A-6000-480).

Sampler

7. After the water begins to flow from the outlet, determine the flow rate and calculate the amount of time required to purge the well (see notes below). Pump the well for the calculated length of time and/or until pH, temperature, and specific conductivity stabilize. If the well being sampled does not have a purge volume listed on the Groundwater Sample Report, pump for a minimum of 15 minutes, and check for stabilization of the pH, temperature, and specific conductivity.

NOTE: Pumping times are usually based on voiding 3 bore-volumes of water from the well. To calculate the pumping time based on field measurement of flow rate:

a. Divide the size of the container (in gallons) by the number of seconds it took to fill. Multiply by 60 to get the new pumping rate (per minute).

b. Divide the purge volume given on the Groundwater Sample Report by the new pumping rate to determine the new pumping time.

NOTE: If the well pumps dry while purging, it does not generally mean that a sample cannot be collected. A sample can still be obtained by following these steps:

a. When the well pumps dry, turn off the pump.

b. Wait for the well to recharge sufficiently to draw a sample (check every 15 minutes).

c. Measure the depth-to-water using the electric measurement tape (e-tape). Make sure that the water level is above the pump intake.

d. Turn the pump back on.

e. Measure pH, temperature and specific conductivity and record on the Groundwater Sample Report. Measure turbidity twice and record on the Groundwater Sample Report.

f. Collect the samples that are designated for collection with the pump.

g. The well may pump dry during the collection of samples. If this occurs, repeat steps (a) through (d) before collecting the remaining samples.

h. If sufficient water to sample has not recharged into the well after a total of 45 minutes, report the problem on the Groundwater Sample Report and on a WSR form and discontinue sampling at that well.

8. Measure the pH, temperature, and specific conductivity of the discharged water at least <u>three</u> times (beginning, middle, and end of the designated purge time) during purging as follows:

   a. The pH is considered stable when two consecutive measurements agree within 0.2 pH units.

   b. Temperature is considered stable when two consecutive measurements agree within 0.2°C.

   c. Conductivity is considered stable when two consecutive measurements agree within 10 percent of each other. If pH, temperature, and conductivity do not stabilize within the listed purging time, contact the FTL/CE before collecting samples.

   d. More readings may be required as stated on the Groundwater Sample Report.

9. Complete the sample label(s) as required by Figure A-1.

10. Record information as it becomes available on the Groundwater Sample Report. Place sample numbers or description of the samples on the Groundwater Sample Report or field logbook as required and on the Chain of Custody/Sample Analysis Request form.

11. Measure turbidity twice and record on the Groundwater Sample Report.

12. Fill the appropriate sample containers as described in Appendix A, Section 5.0, step 2 and succeeding steps.

13. Secure well head upon completion of sampling.

2.0 OBTAINING FILTERED SAMPLES

The pump shall be used to collect a filtered sample <u>only</u> if a by-pass assembly is used to regulate the water pressure going to the filter apparatus. The by-pass must also be capable of maintaining a sufficient water flow to prevent damage to the submersible pump.

Follow these steps to collect a filtered sample from a well that contains a submersible pump.

1. Turn on the submersible pump.

2. Purge the well with the by-pass valve completely open.

3. To collect filtered samples, open the by-pass valve completely.

4. Screw the inlet end of filter assembly (marked "inlet") into the threaded adapter on the sampling manifold. Be careful not to touch filter ends to any surface.

5. Slowly close the by-pass valve or open the sampling valve until a steady flow of water is observed through filter. If too much pressure is exerted across the filter, the membrane will rupture, usually resulting in a popping noise. If this happens, replace the filter and restart the filtering procedure.

6. When a steady flow is achieved, filter 500 mL, as a filter wash, into the 500 mL container or directly into the purge water containment barrel if the flow rate through the filter has been calculated.

7. Dispose of the 500 mL wash (as specified in EII 4.2), and fill the sample bottles as specified on the Groundwater Sample Report and on the sample bottle labels.

8. Turn off the submersible pump and remove the filter assembly from the by-pass assembly.

9. Disconnect the sampling manifold from the well head.

10. Secure well head upon completion of sampling.

APPENDIX C, SAMPLE COLLECTION USING THE HYDROSTAR PUMP

1.0 COLLECTING SAMPLES FROM A WELL CONTAINING A HYDROSTAR PUMP

Sampler

1. On arrival at the well head, remove the locking and protective cap.

2. Immediately determine depth-to-water with an electric measurement tape (e-tape) and record the determined value, estimated to the nearest 0.01 foot, on the Groundwater Sample Report (A-6000-480) or in the field logbook, as required by sampling program protocol.

   a. Perform a visual check for immiscible hydrocarbons such as gasoline and diesel floating on the surface in the borehole.

   b. Observe the end of the tape and record in the field logbook the presence of any greasy, film-like coating or detectable odor.

   NOTE: In situ detectors are currently under evaluation for this purpose. As they become available for general use, these devices will be used to supplement or replace the visual checks.

3. Determine whether the well will be sampled manually or by using the pneumatic cylinder assembly. Use the cylinder if possible.

4. If the well is to be sampled using the pneumatic cylinder assembly, attach the pneumatic cylinder assembly to the well head assembly in the following manner:

   a. Insert the support for the pneumatic cylinder into the column support on the well head assembly.

   b. When inserting the cylinder support into the column support on the pump assembly, at least two holes on the cylinder support must overlap with two holes on the column support.

   c. If less than two holes overlap, use the extension supplied with the Hydrostar pneumatic cylinder.

   d. Align the pumping system in the same manner as described previously.

Sampler

   e. Pull the cylinder rod down until it is fully extended and has stopped.

   f. Align the eyelet on the top portion of the turnbolt with the clevis pin hole on the lower portion of the cylinder rod.

g. Align the hole on the cylinder support with the column support on the well head so that the turnbolt eyelet and clevis pin hole on the cylinder rod are aligned when the piston is fully extended.

h. Insert the clevis pin through one of the intersecting pairs of holes on the column support, and clip a hitch pin into the holes in the small end of the clevis pin.

i. Check the alignment on the turnbolt eyelet with the hole on the cylinder rod. The alignment must be nearly perfect, neither too high nor too low.

j. Attach cylinder rod to the eyelet with the chevis pin and hitch.

k. Adjust by rotating the turnbolt clockwise or counterclockwise.

5. If the well is to be sampled manually, go to step 17.

6. Attach the purge hose to the outlet of the sampling manifold

7. Attach the quick-connect on the supply hose to the unattached end of the control valve on the pneumatic cylinder. The input air pressure should not exceed 120 PSI.

8. Turn on the air supply to the control valve.

9. Turn on the control valve on the pneumatic cylinder. The piston will begin to operate.

10. Adjust the stroke rate to no more than 60 per minute using the control valve located on the top of the pneumatic cylinder. (A stroke is defined as one downward and one upward extension.)

    NOTE: If the pneumatic cylinder assembly is not operating correctly, the well may be hand-pumped as described in step 16. On deep wells the stroke rate could decrease to significantly less than 60 per minute.

Sampler

11. For sampling, slow down the pumping rate just until the piston operates smoothly.

12. After the water begins to flow from the outlet, pump the well for the length of time calculated on the Groundwater Sample Report and/or until pH, temperature, and specific conductivity stabilize. If the well being sampled does not have a purge period listed on the Groundwater Sample Report, pump for a minimum of 15 minutes and check for stabilization of the pH, temperature, and specific conductivity.

NOTE: Pumping times are usually based on voiding 3 bore-volumes of water from the well. To calculate pumping time based on a field measurement of flow rate:

a. Divide the size of the container (in gallons) by the number of seconds it took to fill. Multiply by 60 to get the new pumping rate (per minute).

b. Divide the purge volume given on the Groundwater Sample Report by the new pumping rate to determine the pumping time.

NOTE: If the well pumps dry while purging, it does not generally mean that a sample cannot be collected. Obtain a sample by following these steps:

a. When the well pumps dry, turn off the pump.

b. Wait for the well to recharge sufficiently to draw a sample (check every 15 minutes).

c. Measure depth-to-water using the electric measurement tape (e-tape). Make sure that the water level is above the pump intake.

d. Turn the pump back on.

e. Measure pH, temperature, and specific conductivity once and record on the Groundwater Sample Report. Measure turbidity twice and record on the Groundwater Sample Report.

f. Collect the samples that are designated for collection with the pump.

g. The well may pump dry during the collection of samples. If this occurs, repeat steps (a) through (d) before collecting the remaining samples.

h. If sufficient water to sample has not recharged into the well after a total of 45 minutes, report the problem on the Groundwater Sample Report and on a WSR and discontinue sampling at that well.

13. Measure the pH, temperature, and specific conductivity of the discharged water at least <u>three</u> times (beginning, middle, and end of the designated purge time) during purging. If pH, temperature, and conductivity do not stabilize within the listed purging time or field-calculated purging time, contact the FTL/CE before collecting samples.

    a. The pH is considered stable when two consecutive measurements agree within 0.2 pH units.

b. Temperature is considered stable when two consecutive measurements agree within 0.2°C.

c. Conductivity is considered stable when two consecutive measurements agree within 10 percent of each other.

14. Proceed with sampling all unfiltered samples (Appendix A).

    At the discretion of the FTL, bottled air (breathing quality) or inert gas can be used as the air supply for volatile organics sampling. This activity requires that the compressed air supply line be disconnected from the pneumatic pumping assembly and the bottled air supply line be connected in its place.

15. If filtering is required, see Section 2.0 of this appendix.

16. Dismantle the pneumatic pumping assembly as follows:

    a. Disconnect the air supply at the pneumatic cylinder.

    b. Disassemble the pneumatic cylinder in reverse order of substeps 4a through 4g.

17. If the well will be sampled manually with this pump, insert the handle support into the column support on the pump head assembly so that at least two holes on the handle support overlap with two holes on the column support. Figure C-1.

18. Slide the clevis pin through one of the intersecting pairs of holes on the column support.

19. Clip the hitch pin into the hole in the small end of the clevis pin.

20. Remove the turnbolt on the top of the rod at the well head.

21. Attach the turnbolt on the end of the wire rope attached to the handle assembly onto the threaded rod at the top of the well head.

22. Lift the handle so that the flat edge of the cam nearest the shackle is approximately parallel with the ground.

23. Pull all the slack out of the wire rope.

24. Using either an adjustable or 9/16-inch open-end wrench, tighten both nuts on the shackle until the sheath on the wire rope is compressed. Remember to keep all the slack out of the wire rope.

25. Attach the sampling hose to the outlet of the sampling pump.

26. Begin pumping the operating handle with smooth, even strokes. For best performance, use 20 to 45 strokes per minute for purging the well. When the filter assembly is attached, special attention is required to prevent rapid build up of pressure across the filter. If too much pressure is exerted across the filter, the membrane will rupture, usually resulting in a popping noise. If this happens, replace the filter and begin sampling for the filtered sample according to Section 2.0 below.

27. Take samples as described in Appendix A after pH, conductivity, and temperature have stabilized.

28. When sampling is completed, disassemble the handle assembly in reverse order of steps 17 through 25.

29. Secure well head.

2.0 OBTAINING FILTERED SAMPLES FROM A WELL CONTAINING A HYDROSTAR PUMP

1. Turn off air to the Hydrostar pump at the piston assembly.

2. Screw the inlet end of the filter assembly (marked "inlet") into the threaded adapter on the sampling manifold, being careful not to touch filter ends to any surface.

3. Slowly turn on the air just until the piston operates smoothly. If too much pressure is exerted across the filter, the membrane will rupture, usually resulting in a popping noise. If this happens, replace the filter and restart the filtering procedure.

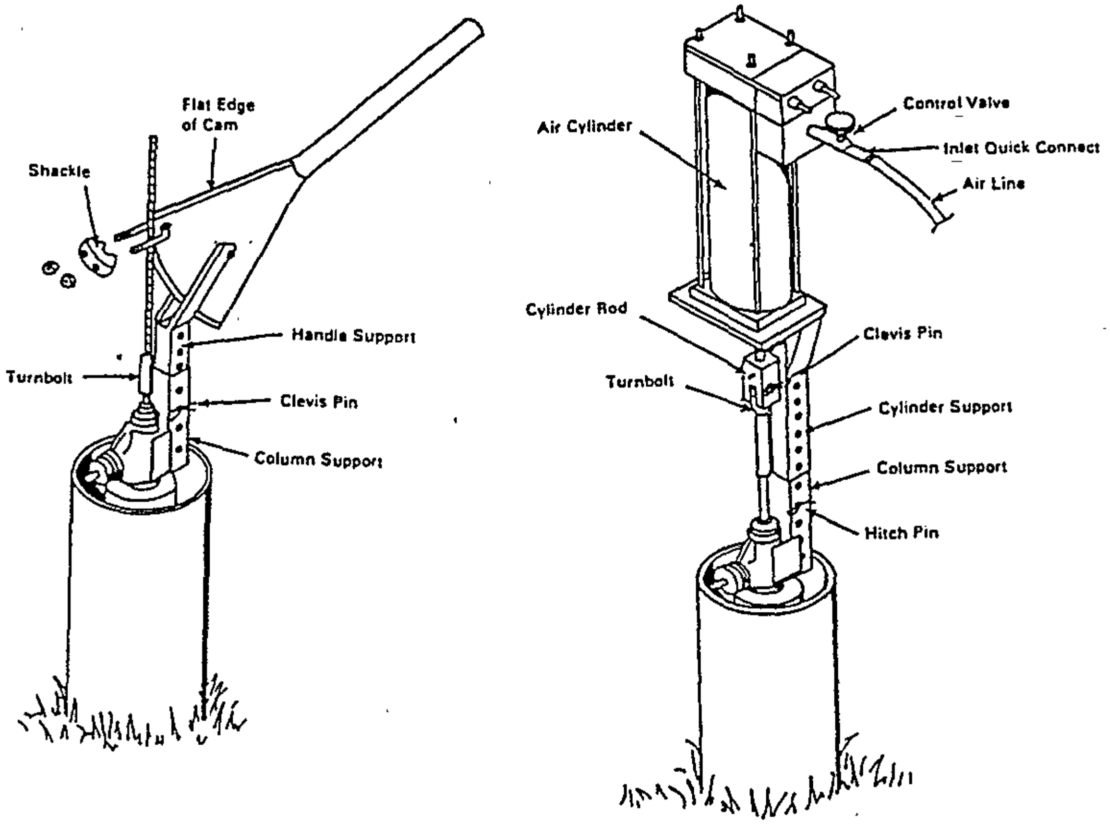
4. Filter 500 mL, as a filter wash, into the 500 mL container or directly into the purge water containment barrel if the flow rate through the filter has been calculated.

5. Dispose of the 500 mL wash (as specified by EII 4.2 of this manual), and fill the sample bottles as specified on the Groundwater Sample Report and on the bottle labels.

6. Turn off the Hydrostar pump, remove the filter assembly, and return the filter assembly to the sample bottle box for proper disposal.

7. Secure well head upon completion of sampling.

Figure C-1. Diagram of Well Head Assembly.



APPENDIX D, SAMPLE COLLECTION USING A BLADDER PUMP

1.0 COLLECTING SAMPLES FROM A WELL THAT HAS A DEDICATED BLADDER PUMP

Sampler

1. On arrival at the well head, remove the locking and protective cap.

2. Immediately determine depth-to-water with an electric measurement tape (e-tape) and record the determined value, estimated to the nearest 0.01 foot, on the Groundwater Sample Report or in the field logbook, as required by sampling program protocol.

   a. Perform a visual check for immiscible hydrocarbons such as gasoline and diesel floating on the surface in the borehole.

   b. Observe the end of the tape and record in the field logbook the presence of any greasy, film-like coating or detectable odor.

   NOTE: In situ detectors are currently under evaluation for this purpose. As they become available for general use, these devices will be used to supplement or replace the visual checks.

3. Turn on the air compressor.

4. Use Figures D-1 and D-2 to hook up the adapter. The diagram of the original system is in Figure D-1. The hookup of the 3017 low-submergence adapter is shown in Figure D-2. All hose ports and connections are marked on the device. A small vacuum pump (Gast pump) is used for suction instead of the air compressor inlet as noted in Figure D-2.

5. Operate the 3111 controller in the normal manner with the 3017 low submergence adapter as shown in Figure D-2. Optimum refill cycle times will be somewhat shorter with the 3017 installed. Note that a minimum pressure of 25 psig has to be maintained through the controller for the 3017 to operate. During purging, the flow throttle on the 3111 controller (located in the lower left-hand corner of the controller panel) should be turned all the way clockwise so that the full 100 psig available from the compressor is delivered to the pump.

Sampler

6. Five to 15 pumping cycles are required to purge the air from the bladder pump and tubing. Full water flow from the sample supply tube should then begin. Take samples after pH, conductivity, and temperature have stabilized.

   NOTE: If the well pumps dry while purging, it does not generally mean that a sample cannot be collected. A sample can still be obtained by following these steps:

   a. When the well pumps dry, turn off the pump.

b. Wait for the well to recharge sufficiently to draw a sample (check every 15 minutes).

c. Measure the depth-to-water using the electric measurement tape (e-tape). Make sure that the water level is above the pump intake.

d. Turn the pump back on.

e. Measure pH, temperature, and specific conductivity once and record on the Groundwater Sample Report. Measure turbidity twice and record on Groundwater Sample Report.

f. Collect the samples that are designated for collection with the pump.

g. The well may pump dry during the collection of samples. If this occurs, repeat steps (a) through (d) before collecting the remaining samples.

h. If sufficient water to sample has not recharged into the well after a total of 45 minutes, report the problem on the Groundwater Sample Report and on a Well Services Request (BC-6000-316) and discontinue sampling at that well.

Sampler

7. To reduce the water-flow rate during sample collection, turn the throttle control on the left side of the control panel counterclockwise. To increase the flow rate, turn the throttle control clockwise.

8. To optimize pumping efficiency for a specific well depth, refer to the pump manufacturer's operating instructions.

9. Secure well head upon completion of sampling event.

2.0 OBTAINING FILTERED SAMPLES FROM A WELL THAT CONTAINS A BLADDER PUMP

1. Set the maximum discharge pressure to 60 psi and turn off the bladder pump controller.

2. Screw the inlet end of the filter assembly (marked "inlet") into the threaded adapter, being careful not to touch filter ends to any surface.

3. Turn on bladder pump (check maximum pressure).

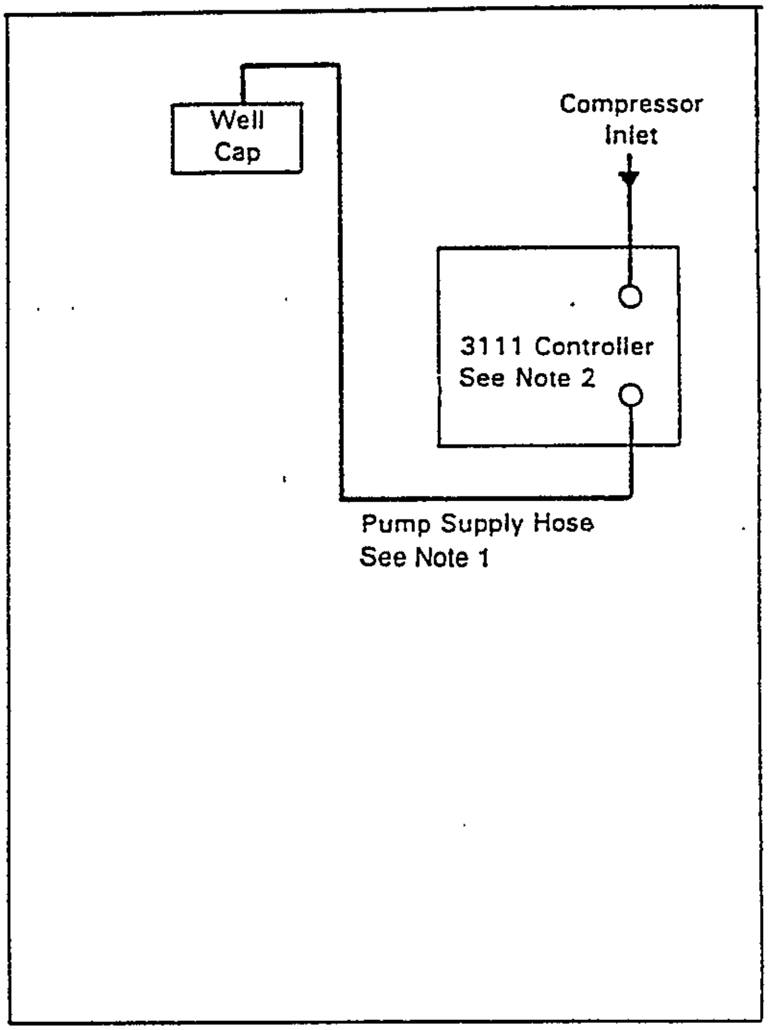
4. Filter 500 mL, as a filter wash, into the 500 mL container or directly into the purge water containment barrel if the flow rate through the filter has been calculated.

5. Dispose of the 500 mL wash (as specified in EII 4.2 of this manual) and fill the sample bottles as specified on the Groundwater Sample Report and on the sample bottle labels.

6. Turn off bladder pump, remove the filter assembly, and return the assembly to the sample bottle box for proper disposal at the laboratory.

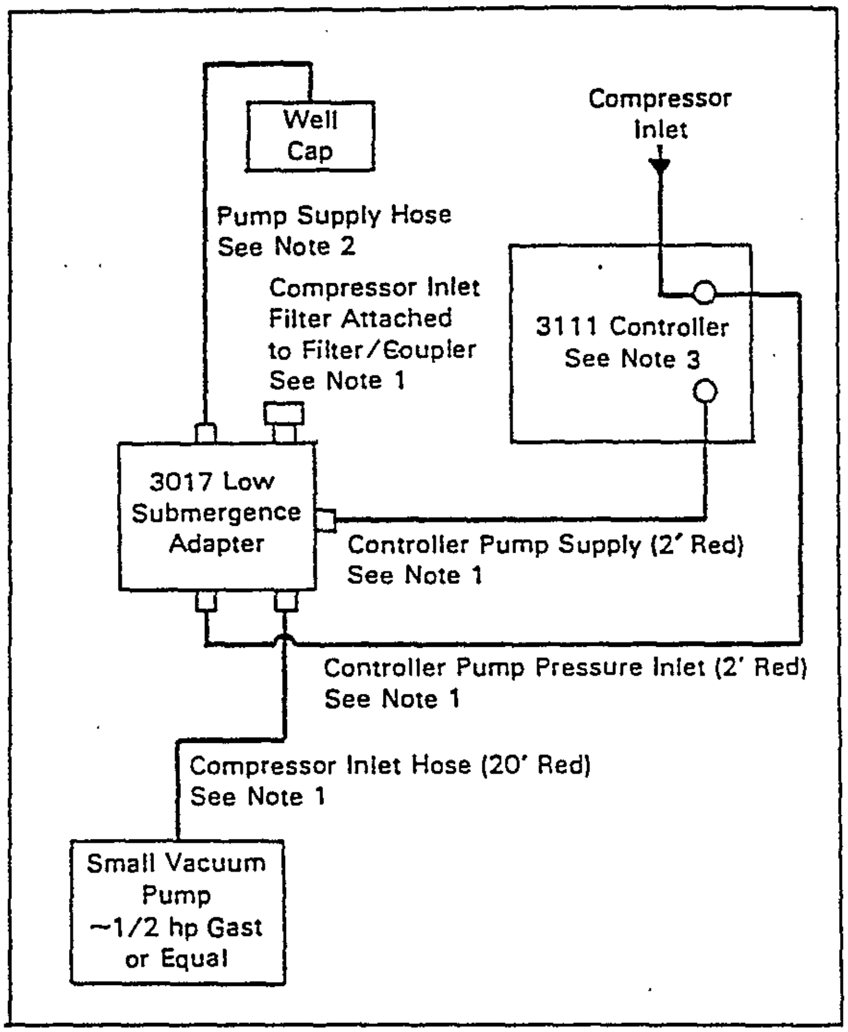
7. Secure well head when sampling is completed.

Figure D-1. Original System for the Bladder Pump.



Notes:
1. Supplied with 3111 Compressor/Driver
2. 25 psig Minimum Required on Controller for Proper Operation

Figure D-2. Connecting the Low Submergence Adapter to the Bladder Pump.



Notes:
1. Supplied with 3017 Low Submergence Adapter
2. Supplied with 3111 Compressor/Driver
3. 25 psig Minimum Required on Controller for Proper Operation

APPENDIX E, SAMPLE COLLECTION USING A TEFLON BAILER

Perform the following steps to collect a sample using a Teflon bailer:

Sampler

1. On arrival at the well head, remove the locking and protective cap.

2. Immediately determine depth-to-water with an electric measurement tape (e-tape) and record the determined value, estimated to the nearest 0.01 foot, on the Groundwater Sample Report or in the field logbook, as required by sampling program protocol.

   a. Perform a visual check for immiscible hydrocarbons such as gasoline and diesel floating on the surface in the borehole.

   b. Observe the end of the tape and record in the field logbook the presence of any greasy, film-like coating or detectable odor.

   NOTE: In situ detectors are currently under evaluation for this purpose. As they become available for general use, these devices will be used to supplement or replace the visual checks.

3. Attach a rope or wire to the Teflon bailer.

4. Slowly lower the bailer into the water.

   a. Never drop the bailer into the well because doing so may cause degassing of volatile organics. Stop lowering when the bailer strikes the water surface.

5. Allow about 30 seconds for the sample tube to fill.

6. Slowly raise the Teflon bailer to the surface.

7. Lower and rinse the bailer twice before collecting a sample.

8. Unscrew the cap of the sample container, being careful not to touch the lip of the bottle or the inside of the Teflon liner. Avoid touching the mouth of the Teflon bailer.

9. Pour the water from the bailer into the sample container slowly to prevent trapping any air bubbles (VOA Samples). Avoid splashing or agitating the water while the sample container is being filled.

10. Obtain sample temperature, pH, turbidity and conductivity and record on the Groundwater Sample Report.

11. Secure well head when completed with sampling.

APPENDIX F, SAMPLE COLLECTION FROM A PIEZOMETER USING THE AIR LIFT METHOD

WARNING: This method cannot be used to sample for volatile organics, total organic halogens, or hydrogen.

Some piezometer tubes are sampled by the air lift method, in which the sample water is pushed up and out of the well by compressed air. A 1/2-inch-diameter PVC tube has been installed in these wells for this purpose.

Sampler

1. On arrival at the well head, remove the locking and protective cap.

2. Immediately determine depth-to-water with an electric measurement tape (e-tape) and record the determined value, estimated to the nearest 0.01 foot, on the Groundwater Sample Report or in the field logbook, as required by sampling program protocol.

   a. Perform a visual check for immiscible hydrocarbons such as gasoline and diesel floating on the surface in the piezometer.

   b. Observe the end of the tape and record in the field logbook the presence of any greasy, film-like coating or detectable odor.

   NOTE: In situ detectors are currently under evaluation for this purpose. As they become available for general use, these devices will be used to supplement or replace the visual checks.

3. Connect the compressor hose to the piezometer tube.

4. Check the gauge on the compressed air tank. It should read in the "operating range" before start of the air lift.

5. Open the regulator valve to pressurize the hose, and continue with the compressor running until water is forced out of the outlet on the side of the piezometer adapter head.

6. Follow the pumping time indicated in the Groundwater Sample Report; however, field conditions may cause some variations in the pumping time (i.e., the flow rates may differ from those listed).

7. Rinse the bucket twice with purge water before filling sample bottles from the bucket.

8. Continue sample collection by following instructions in Appendix A, Section 5.0, step 2.

APPENDIX G, SAMPLE COLLECTION FROM A PIEZOMETER USING THE BAILING METHOD

Piezometer tubes that do not produce enough water to sample by air lift are sampled by the bailing method. The bailer used consists of a flexible rubber tube 1 inch in diameter and approximately 1.5 to 3 feet long. On one end, a brass plug has been inserted and wired in place.

Sampler

1. On arrival at the well head, remove the locking and protective cap.

2. Immediately determine depth-to-water with an electric measurement tape (e-tape) and record the determined value, estimated to the nearest 0.01 foot, on the Groundwater Sample Report or in the field logbook, as required by sampling program protocol.

   a. Perform a visual check for immiscible hydrocarbons such as gasoline and diesel floating on the surface in the piezometer.

   b. Observe the end of the tape and record in the field logbook the presence of any greasy, film-like coating or detectable odor.

   NOTE: In situ detectors are currently under evaluation for this purpose. As they become available for general use, these devices will be used to supplement or replace the visual checks.

3. Bail the piezometer tube in the same manner and with the same precautions as in Appendix E, steps 1 through 10.

4. Pour the sample collected into a sampling bottle until the required amount of sample is obtained.

5. Obtain sample temperature, pH, turbidity and conductivity, and record information on the Groundwater Sample Report.

6. Secure well head before leaving site.

APPENDIX H, SAMPLE COLLECTION FROM A WELL USING A WA TERRA PUMP

1.0 COLLECTING SAMPLES FROM A WELL USING A WA TERRA PUMP

Sampler

1. On arrival at the well head, remove the locking and protective cap.

2. Immediately determine depth-to-water with an electric measurement tape (e-tape) and record the determined value, estimated to the nearest 0.01 foot, on the Groundwater Sample Report or in the field logbook, as required by sampling program protocol.

   a. Perform a visual check for immiscible hydrocarbons such as gasoline and diesel floating on the surface in the borehole.

   b. Observe the end of the tape and record in the field logbook the presence of any greasy film-like coating or detectable odor.

   NOTE: In situ detectors are currently under evaluation for this purpose. As they become available for general use, these devices will be used to supplement or replace the visual checks.

3. Using clean cotton or surgical gloves, attach self-threading foot valve to the end of sample tubing. Lower the tubing (foot-valve end first) to the bottom of the well, and cut flush with the top of the casing. Decontaminate tubing and valve after each use. Appropriate QC sampling is listed in the Groundwater Monitoring Plan.

4. Attach the electric drive mechanism to the riser pipe of the well. The preferred installation is to suspend the mechanism from the top of the riser pipe using the metal hook on the body of the drive mechanism and to tighten the webbing strap around the riser pipe. If sufficient pipe is not available for this type of installation, the hook will not attach, and the unit should be placed on a level base and secured using only the webbing strap.

5. Secure the tubing to the electric drive mechanism by pulling up on the tubing and creating a loop, which is then attached to the bracket on the top of the drive arm and to the bracket on the side of the unit as shown in Figure H-1. Leave 2 to 4 inches of tubing extending beyond the side bracket.

6. Insert the sampling manifold into the end of the sample tube and secure to the drive mechanism by loosening the side bracket, sliding the tubing/manifold section back into the bracket, and retightening.

7. Attach the discharge tubing to the outlet side of the sampling manifold. The other end of the tubing is extended to the purge water truck for collection of discharge water. Collect the purge water according to steps in EII 10.3 of this manual.

8. Ensure the drive mechanism switch is in the "off" position. Connect the power line for the electric drive mechanism to a portable generator or to a fixed power source. Turn on the generator.

9. Adjust the stroke rate of the drive mechanism for smooth operation. (A stroke is defined as one downward and one upward extension.)

10. After the water begins to flow from the outlet, pump the well for the length of time indicated on the Groundwater Sample Report and/or until pH, temperature, and specific conductivity stabilize. If the well being sampled does not have a purge period listed, pump for a minimum of 30 minutes and check for stabilization of the pH, temperature, and specific conductivity.

    NOTE: Pumping times (shown on the Groundwater Sample Report) are usually based on voiding 3 bore-volumes of water from the well at a pumping rate of 1 gpm. To calculate an adjusted pumping time based on a field measurement of flow rate:

    a. Divide the size of the container (in gallons) by the number of seconds it took to fill. Multiply by 60 to get the new pumping rate (per minute).

    b. Divide the purge volume given on the Groundwater Sample Report by the new pumping rate to determine the new pumping time.

    NOTE: If the well pumps dry while purging, it does not generally mean that a sample cannot be collected. A sample can still be obtained by following these steps:

    a. When the well pumps dry, turn off the pump.

    b. Wait for the well to recharge sufficiently to draw a sample (check every 15 minutes).

    c. Measure the depth-to-water using the electric measurement tape (e-tape). Make sure that the water level is above the pump intake.

    d. Turn the pump back on.

    e. Measure pH, temperature, turbidity and specific conductivity and record on the Groundwater Sample Report.

    f. Collect the samples that are designated for collection with the pump.

    g. The well may pump dry during the collection of samples. If this occurs, repeat steps (a) through (d) before collecting the remaining samples.

h. If sufficient water to sample has not recharged into the well after a total of 45 minutes, report the problem on the Groundwater Sample Report and on a Well Services Request (BC-6000-316) and discontinue sampling at that well.

11. Measure the pH, temperature, and specific conductivity of the discharged water at least three times (beginning, middle, and end of the designated purge time) during purging. If pH, temperature, and conductivity do not stabilize within the listed purging time or field-calculated purging time, contact the FTL/CE before collecting samples.

    a. The pH is considered stable when two consecutive measurements agree within 0.2 pH units.

    b. Temperature is considered stable when two consecutive measurements agree within 0.2 °C.

    c. Conductivity is considered stable when two consecutive measurements agree within 10 percent of each other.

12. Measure turbidity twice and record on the Groundwater Sample Report.

13. Proceed with sampling all unfiltered samples (Appendix A).

14. If filtering is required, see Section 2.0 of this appendix.

15. At the completion of sampling, dismantle the sampling assembly as described below.

    a. Turn off the electric drive mechanism.

    b. Disassemble the sampling system in reverse order of substeps 3 through 6.

    c. Slide the sample tubing back into the riser pipe until it rests on the bottom of the well.

    d. Secure well head.

2.0 OBTAINING FILTERED SAMPLES FROM A WELL USING A WA TERRA PUMP

1. Turn off flow to the sample manifold drop leg.

2. Screw the inlet end of the filter assembly (marked "inlet") into the threaded adapter on the sampling manifold, being careful not to touch filter ends to any surface.

3. Turn on flow to the sample manifold drop leg and filter 500 mL, as a filter wash, into a 500 mL container or directly into the purge water containment barrel if the purge rate has been calculated.

4. Dispose of the 500 mL wash (as specified by EII 4.2 of this manual) and fill the sample bottles as specified on the Groundwater Sample Report and on the bottle labels.

5. Turn off the flow to the sample manifold drop leg, remove the filter assembly, and return the filter assembly to the sample bottle box for proper disposal.

6. Secure well head when sampling is completed.

Figure H-1. Wa Terra Hydrolift Driver and Sampling Configuration.

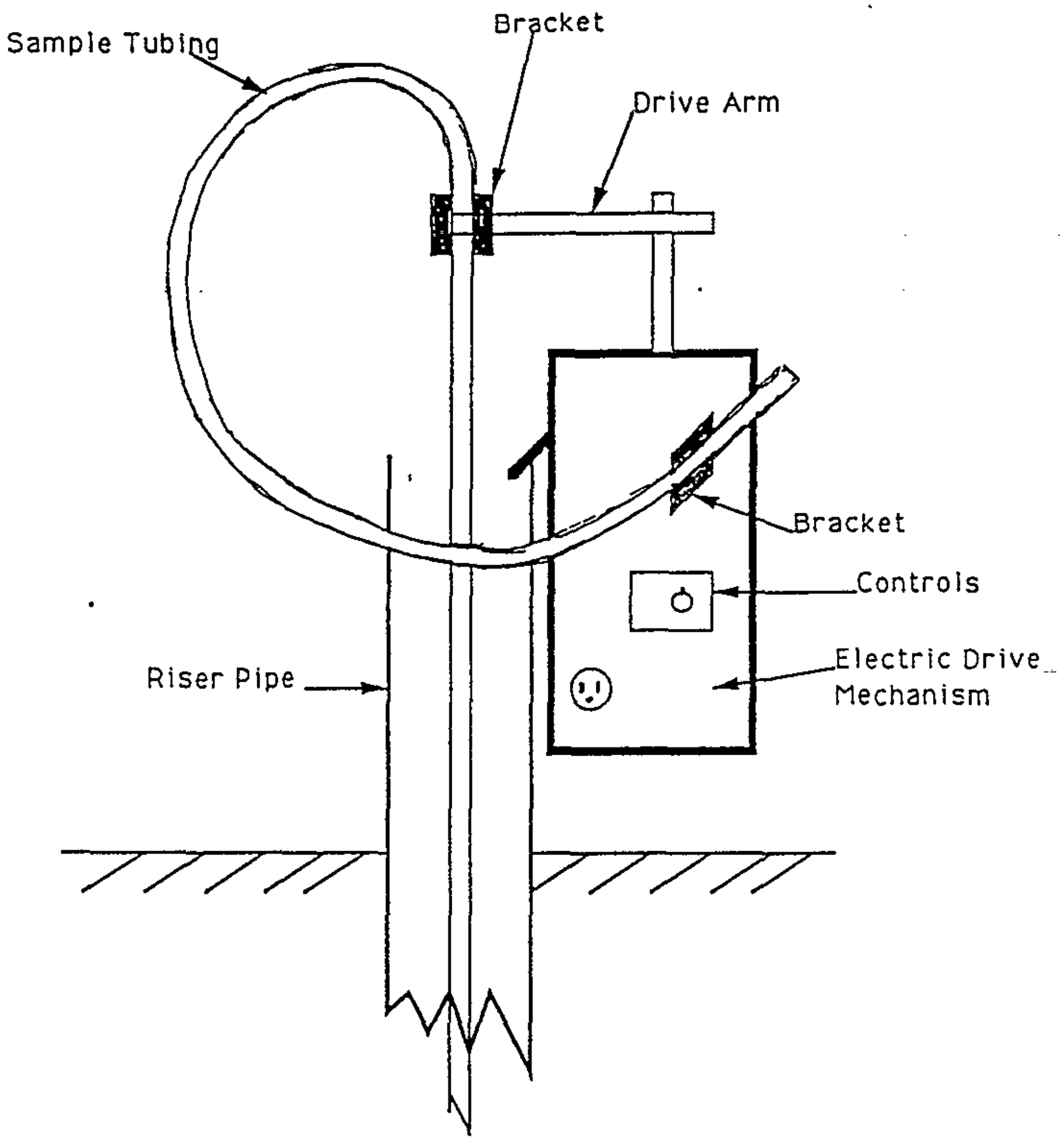


Figure H-1. WaTerra Hydrolift Driver and Sampling Configuration.

INSTRUCTION CHANGE AUTHORIZATION (ICA)

ICA No. 101

Instruction No.	Rev. No.	
EII 5.8, Groundwater Sampling, Appendix B and D	4	Page 1 of 1

Description of Change — Approval Designator Q

A portable submersible pump (Grundfos Redi-Flo pump) and a portable bladder pump may be used for the RCRA/Operational monitoring program. The portable pumps for the operational wells will be cleaned with deionized water after each well. The portable pumps used for the RCRA wells will be cleaned with deionized water after each well and an equipment blank will be collected for analysis at the laboratory. Equipment blank requirements will be given by the Quality Control Task Leader. The tubing and pumps will be surveyed by an HPT (if necessary) before leaving a contaminated well or site.

[] One Time [x] Permanent

Justification

The portable systems allows the personnel to install and sample wells without dedicated pumps. The portable submersible and bladder systems also enables the sampling personnel to adjust the purge flow for micropurging and sampling quality.

Approvals: (Print/Sign Name and Date)

K.F. Donnelson *K.F. Donnelson*	6-11-96	D.G. Horton *D.G. Horton*	6/11/96
ICA Author	Date	ICA Author's Manager	Date
D.G. Horton *D.G. Horton*	6/11/96	W.R. Thackaberry *W.R. Thackaberry*	6/11/96
Instruction Author's Manager	Date	Quality Assurance (If Required)	Date
		N/R	
Other	Date	Safety (If Required)	Date

A-6000-370 (05/95) WEF158

INSTRUCTION CHANGE AUTHORIZATION (ICA)

ICA No. 102

Instruction No.	Rev. No.	
WHC-CM-7-7, EII 5.8 Appendix A, "Groundwater Sampling"	4	Page 1 of 1

Description of Change — Approval Designator Q

The QED Purge Savor may be used in groundwater monitoring for the RCRA/Operational program. The Purge Savor is a flow through system with the capabilities of measuring pH, conductivity, temperature, oxidation-reduction potential (ORP), and dissolved oxygen (DO). Calibration and operation of the QED system will follow WHC procedures and the Purge Savor Flow-Through Cell and Meter System User's Guide. Monitoring activites will be sampled from dedicated equipment. In the case of non-dedicated equipment, procedures for decontamination of sampling equipment and quality control monitoring are to be followed.

[ ] One Time [x] Permanent

Justification

The QED Purge Savor may be used to measure pH, conductivity, and temperature on a routine basis for the RCRA/Operational program. DO, and ORP will be used if requested. The flow-through system will provide reliable field parameters, increased efficiency, and stability of parameters in a closed system. The QED Purge Savor will also reduce purge volumes by instantaneously monitoring the groundwater.

Approvals: (Print/Sign Name and Date)

KF DONNELSON	8-15-96	DG HORTON	8/15/96
ICA Author	Date	ICA Author's Manager	Date
N/A		WR THACKABERRY	8/15/96
Instruction Author's Manager	Date	Quality Assurance (If Required)	Date
N/A		N/A	
Other	Date	Safety (If Required)	Date

INSTRUCTION CHANGE AUTHORIZATION (ICA)

ICA No. 103

Instruction No.	Rev. No.	
WHC-CM-7-7, EII 5.8 Appendix I, "Groundwater Sampling"	4	Page 1 of 3

Description of Change — Approval Designator Q

An appendix to EII 5.8 is being added to accommodate KABIS sampling. This process is to be implemented to sample discrete intervals within the aquifer in support of CERCLA groundwater monitoring activities.

[] One Time [X] Permanent

Justification

The KABIS sampling process has been utilized by the ERC in sampling of CERCLA groundwater wells. The CERCLA sampling was transferred over to RFSNW Sampling Operations as of January 1, 1997. The ERC requires that this process be implemented in certain cases to obtain comparable data for vertical profiling.

Approvals: (Print/Sign Name and Date)

DL Edwards (RFSNW) [signature]	2-18-97	PK Brockman (RFSNW) [signature]	2/18/97
ICA Author	Date	ICA Author's Manager	Date
		WR Thackaberry (RFS) [signature]	2-19-97
Instruction Author's Manager	Date	Quality Assurance (If Required)	Date
DL Stewart (PNNL) [signature] 2/18/97		NA	
Other	Date	Safety (If Required)	Date

Description of Change (continued)

APPENDIX I, SAMPLE COLLECTION USING THE KABIS SAMPLER

The KABIS sampler may be used to collect groundwater samples from discrete intervals within the aquifer. The sampler is designed to take advantage of self-purging through-well flow and to collect representative samples from selected intervals in a water column with minimal interference to the natural flow of groundwater. Samples are collected via a unique sampling mechanism that minimizes turbulence and mixing with air that may compromise chemical integrity of the specimen.

The KABIS sampler comes in three models capable of collecting volumes of one liter, three 40mL vials, and one 40mL vial.

The KABIS sampler shall be used only when directed by the project scientist.

1.0 COLLECTION OF SAMPLE

Sampler

1. On arrival at the well head, remove the locking and protective cap.

2. Immediately determine depth to water with an electric measurement tape (e-tape) and record the determined value, estimated to the nearest 0.01 foot, on the Groundwater Sample Report or in the field logbook, as required by sampling program protocol.

   a. Perform a visual check for immiscible hydrocarbons such as gasoline and diesel floating on the surface in the borehole.

   b. Observe the end of the tape and record in the field logbook the presence of any greasy, film-like coating or detectable odor.

3. Ensure that the KABIS sampler to be used has been initially decontaminated per EII 5.5 of this manual.

4. Using surgeons gloves, screw the sampling vial(s) into the sampler head.

5. Wrap the threads of the sampler head with teflon tape.

6. Thread the head of the KABIS onto the sampler body.

NOTE: **Keep the threading process as smooth as possible (this may require two people) to avoid breaking the sample vial necks.**

7. Attach the sampler to the lowering device by securing the gate clip on the wire.

NOTE: **If samples are required from multiple intervals within the well sampling shall begin with the uppermost interval and continue downward. This avoids mixing of the water column.**

NOTE: **The tolerance for collecting an at-depth sample is plus/minus 1**

8. Slowly lower the sampler to the pre-determined sampling depth.

NOTE: Depth is measured to the top intake port. Once submerged, the sampler should not be stopped at any point prior to the pre-determined depth to avoid premature filling.

9. Allow 10 minutes for the sampler to fill.

10. Slowly retrieve the sampler to the surface.

11. Carefully unscrew the sampler head, remove the vial(s), and replace the original vial caps on the vials.

12. Complete and affix the sample labels to the vial(s).

13. Secure well head upon completion of sampling.

2.0 EQUIPMENT DECONTAMINATION (FIELD)

NOTE: While field decontamination is ongoing a second sampler may be used to collect the sample from the next interval.

NOTE: At some sampling locations phosphate free detergent may not be used. In this case the triple rinse with RO/DI water shall be sufficient.

1. Thoroughly decontaminate all surfaces of the sampler with phosphate free detergent and RO/DI water.

2. Triple rinse with RO/DI water before further use.

TITLE:

SOIL-GAS SAMPLING

Approved by

W. H. Price, Manager
Field and Analytical Sampling Support

1.0 PURPOSE

The purpose of this environmental investigations instruction (EII) is to provide general guidelines for performing soil-gas sampling activities. Soil-gas sampling is a screening tool used for detecting and assessing the distribution of Volatile Organic Compounds (VOC) in the vadose zone and/or groundwater. Soil-gas sampling can be used as a non-intrusive reconnaissance technique to help select optimal placement of boreholes, test pits, monitoring wells, or other sampling methods within the vadose zone.

2.0 SCOPE

This EII applies to soil-gas sampling activities performed at the U.S. Department of Energy (DOE) Hanford Site. This EII provides general guidelines for soil-gas sampling and related activities. Site-specific requirements defining sampling methods and locations will be provided by individual Work Plans and/or Sampling and Analysis Plans (SAP). Quality control requirements are provided in the Work Plans, Description of Work, SAP, or by a site-specific Quality Assurance Project Plan.

3.0 DEFINITIONS

See the Glossary/Acronyms section of this manual.

4.0 REQUIREMENTS

4.1 Safety Requirements

1. Sampling activities shall comply with the site-specific health and safety plan for access control, radiation and environmental hazards monitoring, and personal protective equipment.

2. Personnel shall be trained and qualified and shall meet the applicable requirements of EII 1.1, "Hazardous Waste Site Entry Requirements."

*This is a total rewrite; therefore, no revision bars are used to indicate changes.

4.2 Sample Numbers

When HEIS Numbers are required, soil-gas samples shall be numbered as specified in the project-specific SAP and in accordance with EII 5.10, "Obtaining Sample Identification Numbers and Accessing HEIS Data."

5.0 PROCEDURE

5.1 Before Sampling Operations Begin

Management

1. Assign personnel to projects.

FTL/Cognizant Engineer

2. Assign project personnel responsibilities (may vary depending on the magnitude of the sampling operation and the method employed).

3. Meet with field personnel to review safety precautions, environmental monitoring requirements, general scope of sampling activities, and specific quality control information.

4. Ensure all "driving" tools are inspected and deemed safe to operate in the manner intended.

NOTE: Ensure equipment is maintained and repaired.

Sampling Team

5. If needed, establish the sampling grid and mark the grid using appropriately labeled stakes.

NOTE: The grid should be tied to at least one control point or baseline with known coordinates. The grid size may be increased or decreased during the course of sampling to better define areas of interest and to determine the extent of soil-gas anomalies when they are discovered.

6. Inspect all tools and equipment to ensure they will operate in the manner intended.

7. Decontaminate sampling equipment, as needed, that will directly contact contaminated samples. Some reusable sampling equipment may be decontaminated following the guidance of EII 5.5, "1706-KE Laboratory Decontamination of RCRA/CERCLA Sampling Equipment."

FTL/Sampler

8. Do not use soil-gas sampling equipment that is suspected of damage or contamination.

5.2 During Sampling Operations

FTL

1. After all pre-sampling requirements have been met and documented in the field logbook, authorize and direct sampling operations and coordinate onsite support activities.

2. During sample collection, ensure the samples are free of ambient contaminants. This may require shutting down nearby internal combustion engines and suspending nearby fueling operations.

3. Routinely record weather conditions, including temperature, wind speed and direction, barometric pressure and trend (rising or falling), and recent precipitation.

NOTE: Weather information may be obtained from a weather station if one exists near the survey site.

4. Provide any details needed for sampling that are not contained in the SAP. Document these details and the rationale supporting them in the field logbook.

NOTE: Appendix A presents general guidelines for installing probes and collecting soil-gas samples. The site-specific SAP should define the specific equipment and methods used to conduct the soil-gas survey.

5. Document significant changes in sample location in the field logbook, giving the distance and direction from the nearest survey stake, along with the reason for the change.

HPT

6. If needed, perform radiation monitoring in accordance with the Radiation Work Permit.

Site Safety Officer

7. If needed, provide health and safety monitoring in accordance with the approved site-specific health and safety plan.

Sampler

8. Collect samples (including required quality control samples) at the locations and depths specified in the SAP or by the FTL.

9. Record the sample location, purge volume, time, date, sampler, and other pertinent observations in the field logbook.

5.3 After Sample Collection

Sampler

1. Properly collect, seal, label, and package individual soil-gas samples. Samples should be protected from light and excessive changes in temperature and atmospheric pressure.

2. Maintain field custody of all samples pending transportation to the analytical laboratory.

3. If needed, complete a Chain of Custody/Sample Analysis Request form.

HPT

4. If needed, survey and release samples for analysis.

FTL

5. If needed, coordinate transportation and shipment of samples with appropriate organizations.

Sampling Team

6. Ensure prompt delivery of the sample and chain of custody documentation (if needed). Generally, samples should be delivered to the laboratory within 30 minutes, depending on analytes, container type, preservation methods, and detection limits.

NOTE: Use of mobile laboratories and onsite portable instruments should be considered for analysis. Where samples are to be analyzed onsite, sample labeling, packaging, sealing, chain of custody, and other requirements may be abbreviated.

7. If needed, decontaminate non-disposable sampling equipment before it is reused.

NOTE: Use of disposable sampling equipment is recommended to reduce potential contamination of samples.

Analysis Team

8. Maintain custody of all samples pending analysis.

9. Operate analytical equipment in accordance with the manufacturer's specifications and the requirements of the project-specific SAP.

10. Ensure samples are analyzed in a timely fashion in accordance with the project-specific SAP.

Analysis Team

11. Analyze required quality control samples (equipment blanks, method blanks, duplicate samples, split samples, calibration standards) in accordance with the manufacturer's specifications and the requirements of the site-specific SAP.

12. Decontaminate sampling and analysis equipment as needed.

6.0 RECORDS

Record processing and disposition is in accordance with the following table. The following documents are to be put on a transmittal prior to submitting to the FC.

NAME Filing Unit Title or Description	RECORD TYPE*	RETENTION PERIOD	DISPOSAL AUTHORITY	CUT-OFF AND RETIREMENT INSTRUCTIONS
Field Logbooks	QA	TPA + 10 years	DRS 1.8c TBD	Submit weekly copies to FC; submit completed logbook to FC upon project completion or when no longer needed for transmittal to IRM permanent storage
Chain of Custody (A-6000-407, WEF061); Sample Analysis Request (A-6000-406, WEF060); Chain of Custody/Sample Analysis Request (BC-6000-828)	QA	TPA + 10 years	TBD	The laboratory returns the completed form(s) with the sample analytical data package(s). Analytical data packages are transmitted to IRM permanent storage in accordance with approved RIDS

* DRS = Department of Energy Record Schedules; FC = File Custodian; QA = Quality Assurance; TBD = To be determined; TPA = Tri-Party Agreement

7.0 DESIGNATED REVIEWING ORGANIZATIONS

None.

8.0 FORMS

Chain of Custody (A-6000-407, WEF061)

Chain of Custody/Sample Analysis Request (BC-6000-828)

Sample Analysis Request (A-6000-406, WEF060)

APPENDIX A

PROCEDURE FOR CONDUCTING SOIL-GAS SURVEYS

1.0 BACKGROUND

Soil-gas sampling consists of inserting sampling probes into the upper, unsaturated portion of the soil profile (referred to as the vadose zone) and collecting subsurface gas samples. The gas samples are tested for detectable concentrations of volatile organic compounds (VOCs). Soil gas sampling can be used to characterize a potentially contaminated site. Soil gas sampling can also be used as a recognizance tool for selecting optimal locations or boreholes, test pits, monitoring wells, and other sampling methods.

Interpreting soil-gas data may be complex and is highly site specific. Site-specific geophysical information and, if possible, careful comparisons with available "ground truth" such as waste inventories, soil samples, or samples from nearby groundwater wells are crucial to reliable interpretation of soil-gas data.

Currently, no method for performing soil-gas surveys is universal, and none is mandated by existing regulations. Instead, several methods are recommended depending on the scope and objectives of the survey. A new guide prepared by the American Society for Testing and Materials (ASTM) contains several guidelines for conducting soil-gas surveys. This publication, ASTM Designation D 5314 - 93, "Standard Guide for Soil Gas Monitoring in the Vadose Zone," has been used to prepare the following methodology, which is applicable to conditions and work practices on the Hanford Site.

2.0 METHODS

2.1 Obtaining Preliminary Information and Required Permits

All sampling activities shall comply with the site-specific health and safety plan for access control, monitoring of radiation and environmental hazards, and personal protective equipment. Field personnel shall be trained and meet the requirements of EII 1.1 "Hazardous Waste Site Entry Requirements."

1. Determine the exact location and condition of the site to be studied. Obtain copies of pertinent site maps and drawings showing the location of the site with reference to survey grids and nearby landmarks.

2. Inspect the site and the nearby area. If possible, obtain information on the history, land use, and general geology of the site. This information is useful for positioning the soil gas

probes and interpreting the analytical data. In addition, the location of underground utilities such as electrical, water, telephone, or steam lines should be thoroughly investigated and marked.

3. A Ground Penetrating Radar (GPR) survey should be conducted in the area before the soil gas sampling locations are determined. This information is very useful for verifying the location of tanks, utilities, and areas of soil disturbance. The GPR survey may also help determine some geophysical conditions and the best sampling locations and depths.

Three primary documents must be prepared before beginning the soil-gas survey.

4. A Sampling and Analysis Plan (SAP) must be completed and approved before field work can be initiated. For surveys conducted to support a formal site investigation, the SAP should be a cleared, technical document. For surveys conducted to provide field-screening data for smaller informal investigations, the SAP could be issued as a documented letter. The SAP should include a brief description of the site, methods used to install and sample the probes, and analytical methods.

5. A site-specific Health and Safety Plan (HASP) must be completed before installing the soil-gas probes and collecting samples. The HASP will assess potential hazards and prescribe control measures and personal protective equipment for the job. The HASP must be approved by WHC Safety.

6. An Excavation Permit must be completed for installing the soil-gas probes. The excavation permit is important to help locate buried utilities, tanks, pipes, obstructions, areas of radioactive contamination, or other potential hazards. Complete the excavation permit form and attach copies of pertinent maps and drawings. Several approvals are needed on the excavation permit. A Cultural Resource Review must be completed and approved on the permit. In addition, a biological assessment of the job site must be completed and documented to ensure the task does not disturb protected flora and fauna. Other approvals needed for the excavation permit include Environmental Protection, Health Physics Monitoring, and the Facility Manager for the job site. In some cases, other approvals may be needed.

2.2 Establishing Sampling Points

1. Lay out the soil sample points or survey grid at the site. The sample points or survey grid should be located in reference to at least one known, surveyed location. This can include buildings, fences, telephone poles, survey monuments, or other permanent structures where an exact location is known and documented or can be determined.

2. Locate each sample point as carefully as possible using precise compass bearings and distance measurements. If a GPR survey was conducted, use the GPR grid and survey information to locate the sample points in the best monitoring locations and to avoid underground utilities and other obstructions. The objectives of the study will determine the desired spacing of the probes. For grid sampling, the sample points should be no more than 100 feet apart. Placing the sample points closer together, 25 to 50 feet apart, generally enables more accurate interpretation of the data. A useful strategy is to start with a coarser grid and add sampling points where needed to define the distribution of detected contaminants.

NOTE: The scope and purpose of the survey is important for determining placement of the probes. If potential contaminants are anticipated at a uniform depth then the probes should be placed at the same depth in a single soil horizon. If the contaminants are anticipated at varying depths, probes should be driven to multiple depths to obtain a depth profile of the contaminants.

3. Mark each sampling point or the survey grid with wooden stakes and label them with the sample numbers or grid locations for easy identification in the field.

4. Record all pertinent information and a sketch of the sampling layout in the field logbook. Use of the field logbook shall comply with requirements of EII 1.5, "Field Logbooks."

2.3 Installing the Soil-Gas Probes

For most soil-gas surveys on the Hanford Site, dedicated soil-gas probes are used. The dedicated probes consist of a drive point with an intake section attached to a length of ¼-inch teflon tubing. The teflon tubing extends to the soil surface and is capped to prevent contamination of the tubing. The dedicated sample points may be driven with a variety of equipment including electric rotary hammers, pneumatic hammers, and hydraulic hammers.

1. Insert the soil-gas probe as close to the marked location as possible. Record any changes in location and information on the soil or site locations in the field logbook.

2. Drive the soil-gas probe to the desired depth. In general, probes should be driven at least 4 feet below ground surface. If the probe cannot be driven 4 feet, an additional probe should be driven nearby to the desired depth.

3. In surface radiation zones or areas where soil contamination may be a problem, spread a plastic tarp over the area where the probe is being installed. Drive the probe through a hole approximately 6 inches in diameter cut in the middle of the tarp. This step helps

control spread of potential contamination and helps keep the probe driving equipment free of contamination.

4. Remove the drive assemblies using a hydraulic jack or other similar device and seal the hole annulus around the sample probe. Depending on the equipment used to install the probe, the annulus may be sealed with native soil or with clean silica sand capped with a sand/bentonite mixture.

5. Cap the sample tube and mark the location with flagging labeled with the sample number or grid location numbers.

6. Record the time of probe installation, depth of penetration, and any other pertinent information in the field logbook.

7. Wipe down the exterior of the probe driving assembly to remove loose soils and potential contaminants. This step is especially important when installing soil-gas probes in a radiation area. Unless the survey area is heavily contaminated with VOCs, it should not be necessary to decontaminate the drive assembly rods between sample points.

NOTE: Decontamination of the drive assembly rods is generally not needed because the soil-gas samples are withdrawn through dedicated teflon sample tubes. The inside of the teflon tubing does not become contaminated by the drive assemblies.

2.4 Collecting the Soil-Gas Samples

In order to minimize sample collection and analysis, soil-gas samples should be analyzed using a graded approach. The first analyses are conducted using portable total-vapor instruments such as a Photoionization Detector (PID), Flame Ionization Detector (FID), Infrared Analyzer (IRA), combustible gas analyzer, or other suitable instruments. Often several different instruments are used in succession. The total vapor results are used to determine potentially contaminated areas and focus further sampling and more definitive analysis using gas chromatographs (GC) or other similar instruments.

1. No internal combustion engines should be operated in the immediate vicinity while collecting samples.

2. Calibrate each portable total-vapor instrument used at the survey site following the manufacturer's procedures. After calibration, the instrument response should be challenged using a check standard in the anticipated concentration range of potential contaminants. Record the calibration steps and the instrument response in the project field logbook.

3. When screening soil-gas using portable total-vapor instruments, purge each sample probe of a minimum of 3 purge volumes of soil gas. Record the instrument response after the probe has been purged and the instrument readings stabilize.

NOTE: If more than one total-vapor instrument is used in succession, the sample probe should be purged only once. The probe does not need to be purged for each successive instrument. Record successive instrument response after the readings stabilize.

4. When collecting samples for analysis, assemble and test the sample pump assembly. The sample pump may consist of an expendable plastic syringe and 3-way valve assembly or a portable electric sampling pump. A portable total-vapor instrument that does not affect the chemical composition of the sample (such as a PID) can also be used to purge the sample tube and monitor for potential vapors. The total vapor readings can then be used to help the analyst determine appropriate sample volumes to avoid overloading to the GC.

5. Purge the sample probe of a minimum of 3 purge volumes of soil gas. The purge volume should also include the volume of the specific sample container being used.

6. Collect the gas sample in the desired container. If possible, the sample pump should be installed at the end of the sample train. Sample containers may include tedlar bags, gas-tight syringes, glass vials, glass bulbs, or other clean sample containers.

7. Record the sample location, purge volume, time, date, sampler, and any other pertinent observations in the field logbook. Local meteorological conditions at the site should also be recorded in the field logbook at the beginning and end of the sampling period.

8. Transport the sample to the laboratory for analysis. When possible, the sample should be analyzed on site using portable or transportable analytical instruments. If offsite analysis is used, the samples should be shipped and handled in accordance with protocols specified in the SAP. This should include the use of HEIS numbers and chain of custody records following the requirements of EII 5.10, "Obtaining Sample Identification Numbers and Accessing HEIS Data" and EII 5.1, "Chain of Custody."

9. Purge any pumps and sampling equipment with clean, ambient air before the equipment is used to collect another sample.

2.5 Collecting Quality Control Samples

Based on the data quality objectives for the survey, Quality Control (QC) samples and protocols should be specified in the SAP. As much as possible, the QC samples should be collected and analyzed in the same manner and under the same conditions as the routine soil-gas samples.

The QC samples may include method blanks, ambient samples, equipment blanks, replicate samples, spiked samples, and calibration standards.

1. Method blanks should be analyzed at the beginning and end of each analytical day. The method blank may consist of an analysis of the instrument carrier gas or zero air.

2. Ambient air samples should be analyzed at the beginning of each sampling episode. Ambient air samples should be collected from an area that is representative of the study site. The ambient air sample should be collected in the same manner as the routine soil-gas samples.

3. An equipment blank should be collected and analyzed at the beginning of each sampling episode. The equipment blank may consist of an ambient air drawn through the entire sampling train and collected in the same manner as the routine soil-gas samples.

4. Replicate samples are not required for all soil-gas surveys. If replicate samples are collected, a minimum of one replicate sample should be collected for each sampling episode or for each 20 samples. The replicate samples should be collected and analyzed in the same manner as the routine soil-gas samples.

5. Spiked samples and calibration standards should be analyzed on a routine basis to ensure the precision and reliability of the analytical technique.

2.6 Analyzing Soil-Gas Samples

For most soil-gas surveys, the preferred analytical method is to analyze the samples at the survey site using portable or transportable instruments. There are several advantages to onsite analysis. Onsite analysis eliminates or reduces many factors that may severely affect the integrity of the data such as sample processing, preservation, packaging, and shelf life. In general, the increased sample integrity more than compensates for the potential loss of analytical sensitivity using portable instruments.

1. Select the analytical method most suited for the desired results. This information should be specified in the SAP and will be based on the Data Quality Objectives. Using the graded analytical approach, the types of instruments used include total-vapor instruments (such as a PID, FID, IRA), portable GCs, and other similar instruments.

2. The analytical instruments selected must have low enough detection limits to avoid reporting false negative values. False negative results can lead to invalid conclusions. The minimum detection level is generally defined as the amount of detected material that produces a response equal to twice the baseline noise of the detector.

3. For assessing multiple classes of contaminants, such as chlorinated solvents or fuel compounds, multiple detectors may be needed. Depending on the class of contaminant encountered the detectors needed may include a PID, FID, Electron Capture Detector (ECD), or other type of detector.

4. The instrument operator should follow routine laboratory techniques for analyzing gas samples. The operator should also follow the specific techniques for the particular instrument used. The experience of the operator with the instrument is very important. Excessive instrument capability cannot compensate for operator inexperience.

5. The instrument operator should follow the QC requirements specified in the SAP and the specific QC protocols for the instrument used.

2.7 Interpreting and Reporting Soil-Gas Data

Soil-gas contaminants detected in the vadose zone are indirectly related to contaminants in the soil and groundwater of the survey site. Several factors, such as soil pore space, moisture content, organic content, confining layers in the soil horizon, and ambient weather conditions can impact the concentration and distribution of contaminants in the vadose zone. For these reasons interpreting soil-gas data is highly complex and site specific. It is the responsibility of the interpreter to examine soil gas data in context with other site characteristics using sound judgement and experience.

1. Soil gas data should be interpreted as raw data. Correction factors, such as for depth or other conditions, should not be used.

2. Soil gas data can be highly variable and may differ depending upon the technique used and site conditions encountered during the survey. Care should be taken to control as many variables as possible. Do not combine soil gas data collected using different sampling techniques, different analytical instruments, or under different ambient conditions.

3. If possible, establish "background" or baseline levels of contaminants detected. After a baseline has been established, define subpopulations of soil gas data that differ from the baseline data in concentrations, composition, or both.

4. Report the soil gas survey results in a cleared, technical document or a documented letter depending on the original scope and formality of the survey.

5. The report should include a discussion of the site background and conditions, methods used to install the probes, methods used to collect and analyze the samples, and the results. A map of the probe locations should be included in the report. The results

should include a discussion of the reliability of the results and the analytical detection limits. Any unusual conditions encountered during the survey should be discussed.

6. Compile and report all pertinent field and analytical data including the results of quality control samples.

7. Use aids such as vertical profiles, horizontal profiles, or contour maps to describe and interpret the detected subpopulations of data. If the data are contoured, the contouring routine and data manipulation method should be briefly discussed in the report.

8. If possible, relate soil gas data to other vadose zone information and other sources of "ground truth" information such as groundwater data, waste inventories, field observations, and other knowledge about the site.

3.0 REFERENCES

ASTM Designation: D 5314 - 93, "Standard Guide for Soil Gas Monitoring in the Vadose Zone," American Society for Testing and Materials, Philadelphia, PA, January, 1993.

U.S. EPA, 1968, "Soil-Gas Measurement of Subsurface Organic Contamination," EPA-EMSL 68-03-3050, March, 1968.

U.S. EPA, 1987, "Soil Gas Sensing for Detection and Mapping of Volatile Organics," EPA/600/8-87/036, August, 1987.

U.S. EPA, 1991, "Soil Sampling and Analysis for Volatile Organic Compounds," EPA/540/4-91/001, February 1991.

TITLE:

OBTAINING SAMPLE IDENTIFICATION NUMBERS AND ACCESSING HEIS DATA

Approved by 12/13/91

L. C. Brown, Manager
Environmental Engineering and Geotechnology

1.0 PURPOSE

The purpose of this Environmental Investigations Instruction (EII) is to describe how Hanford Environmental Information System (HEIS) sample identification numbers are requested, generated, assigned and tracked.

2.0 SCOPE

This EII applies to environmental field samples collected and sent for laboratory analysis. It includes the tracking of all sample numbers generated and used for environmental monitoring and restoration activities on the Hanford Site. All new samples collected will be registered within the HEIS.

This EII does not apply to samples collected during effluent monitoring activities at the Hanford Site.

3.0 DEFINITIONS

Hanford Environmental Information System (HEIS). A computerized database used to store, manipulate and retrieve the data that are gathered from many types of environmental samples taken at the Hanford Site. The HEIS consists of a Sequent S27[1] UNIX-based multiprocessor computer and ORACLE[2] software, support hardware, and data.

HEIS Sample Number Library (HSNL). A computer-based sample number generation and tracking system within the HEIS.

HEIS Sample Number. A unique number with a six character field assigned to a sample. Sample numbers in the HSNL conform to a specific convention. This numbering convention is important since the HEIS sample number is a key field for entering laboratory and field data into the HEIS database. The HEIS sample numbering process including sample number configuration control is defined in WHC-EP-0372. The HEIS sample numbering convention is as follows:

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[1]Sequent Computer Systems, Inc., Bellevue, WA

[2]ORACLE Corporation, Redwood Shores, CA

Format: XYYYYN
X = Alpha consonants (no vowels)
Y = Alpha consonants (no vowels) and/or numbers 0-9
N = Numbers 0-9.

4.0 RESPONSIBILITIES

4.1 FIELD TEAM LEADER/COGNIZANT ENGINEER

The Field Team Leader/Cognizant Engineer delegate work together to ensure that samples are taken according to the sampling plan. Generally, the Cognizant Engineer (Project Coordinator) will obtain the HEIS sample numbers while the Field Team Leader assigns the HEIS sample numbers to the samples in the field. The Field Team Leader/Cognizant Engineer is responsible for:

1. Requesting the HEIS sample numbers from the Office of Sample Management (OSM).
2. Assigning the HEIS sample numbers to the field samples.
3. Providing information about the sample in relation to the sample number and recording this information in the field logbook or on appropriate data sheets or forms.
4. Maintaining a traceable record of sample number assignments.
5. Ensuring that the Chain of Custody form(s) are completed in accordance with EII 5.1.
6. Reporting samples (numbers) that are lost/destroyed and returning unused HEIS sample numbers to the OSM.

4.2 HEIS DATA PACKAGE COORDINATOR

The HEIS Data Package Coordinator is responsible for:

1. Obtaining field and laboratory information about the samples from Field Team Leader/Cognizant Engineer or delegate.
2. Compiling the field and laboratory information and organizing them into a HEIS data package.
3. Transcribing field sample data accurately.
4. Acting as a point-of-contact with the Environmental Data Management (EDM) group for questions about the field data contained within the data package.
5. Maintaining a file copy of each HEIS data package submitted to EDM.

4.3 OFFICE OF SAMPLE MANAGEMENT

The OSM is responsible for:

1. Operating and maintaining the HSNL to ensure that the HEIS sample numbers requested by the Field Team Leader/Cognizant Engineer are provided in a timely manner.

2. Entering information into the HSNL database regarding sample number assignment and maintaining a sample status tracking database.

3. Performing data validation on HEIS samples and verifying HEIS sample numbers match laboratory numbers.

4.4 ENVIRONMENTAL DATA MANAGEMENT

The EDM group manages HEIS development and operation.

1. The HEIS Data Custodian is responsible for data entry and other aspects such as developing procedures, training, troubleshooting, verification, and surveillances. A data configuration control system will include procedures and surveillances.

2. The HEIS Software Coordinator will oversee software including test plans, testing, test reports, incident logs, debugging/trouble-shooting, systems analysis, surveillances, and configuration control.

3. Environmental Data Management will provide data entry verification packages for acceptance by the Project Coordinator or delegate.

5.0 REQUIREMENTS

5.1 HEIS USERS

HEIS users will consist of data entry personnel who have update access or users with view-only (read) access such as Project Coordinators and other technical and regulatory users. Update access allows the user to insert, modify, or view data. Persons with read-only access will be able to access the HEIS and/or the HEIS GIS as a resource for planning and conducting field activities, accessing and analyzing data, and for preparing reports. Users of the HEIS will need:

1. The ability to connect with and use the network in which the HEIS is maintained.

2. A personal computer with a keyboard that has at least 10 function keys and one of four emulation packages as described in WHC-SP-0660.

3. A HEIS computer user account and access privileges to a project account.[3]

6.0 PROCEDURE

6.1 HEIS SAMPLE NUMBERING PROCESS

The HEIS sample numbers conform to the U.S. Environmental Protection Agency (EPA) CLP protocol for format as described in Section 3.0. The HEIS sample numbers will not characterize what type the sample is (e.g., soil, water, etc.) by the numbers alone but when they are called-up from the HEIS database, information about the sample location, date, type, etc., is available. The following process describes the activities associated with obtaining HEIS sample numbers:

1. The Field Team Leader/Cognizant Engineer requests (from the OSM) sufficient sample numbers needed for Remedial Investigation/ Feasibility Study (RI/FS) or RCRA Facility Investigations/ Corrective Measure Studies (RFI/CMS) or site-wide monitoring activities. Sample numbers may be requested individually or in blocks to minimize delays in providing sample numbers for ongoing field work. Sample number accountability for blocks of sample numbers is the responsibility of the person to whom the sample numbers were assigned.

   There will be only one unique number per sample to assure no multiple use of a sample number. Each split and/or composite which is generated will be assigned a unique HEIS sample number. The Field Team Leader/Cognizant Engineer will report any lost or damaged samples (that have been assigned HEIS sample numbers). Chain of custody forms are initiated for samples assigned HEIS sample numbers and samples are tracked according to these sample numbers.

2. Duplicate use of a sample number will usually be caught during the chain-of-custody verification process by the OSM and will require a Change Record to the master data package files to provide a record of the initial and final sample numbers for traceability.

3. Following use of a block of sample numbers, the user may provide a sampling summary to OSM. The sampling summary should provide the following information for each sample number used:

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[3]A project account with a control level of "standard" is allowed access to all data also marked with the "standard" control level. No approvals are necessary to obtain a project account with a "standard" control level. Any other control level requires the approval of the HEIS Database Administrator.

- Sample number used
- Date sampled
- Date shipped (to the laboratory)
- Type
- Interval
- Analysis (provide a legend to analytical analysis requested)
- Laboratory (shipped to)
- Offsite Property Control number
- Bill of Lading number.

4. The HEIS Data Package Coordinator compiles the field information (about the HEIS samples) from the Field Team Leader/Cognizant Engineer to produce a HEIS data package that is delivered to EDM for input in the HEIS. The various laboratory analytical results provided by the OSM will be entered into the HEIS when the data becomes available.

5. The Cognizant Engineer (Project Coordinator) will sign/approve the HEIS data package before its delivery to EDM. The flowchart in EII 1.11 shows the relationship between the field work, OSM and HEIS.

6.2 ACCESSING HEIS DATA

6.2.1 HEIS Data Package Subject Areas

The HEIS data packages are developed for various subject areas including: atmospheric, biota, geologic, geophysics, groundwater, soil gas, and survey. The data from these HEIS data packages include the following information:

1. When and where the samples were taken.
2. Who performed the analysis.
3. What method was used during the analysis.
4. The results of the analyses.
5. Traceability to the data source.

6.2.2 HEIS Database Subject Areas

The HEIS database subject areas include site, constituent, sample, survey, geophysics and well. The subject areas are summarized as follows:

1. The site subject area contains basic data about waste sites.

2. The constituent subject area contains data about constituents and analysis methods.

3. The sample subject area tracks the location of the sample and ensures that a unique sample number is used for each sample regardless of type. In most cases, only validated laboratory sample data and field data results are stored in HEIS.

Interpreted results may be stored in the HEIS Geographic Information System (GIS) which resides on a workstation system separate from but linked to the HEIS.

4. The survey subject area contains data on the various surveys performed at the site and the associated survey point locations.

5. The geophysics subject area contains data concerning surveys of waste sites.

6. The well subject area stores information relevant to the construction of the wells and boreholes, structural modifications to existing wells and boreholes, and the location of wells and boreholes.

Comprehensive instructions for data entry into the HEIS are included in WHC-SP-0660. Detailed information for where and how sample data is stored in the HEIS may be found in WHC-EP-0372.

6.3 DATA VIEWING

Once the requirements have been met for read-only access (Section 5.1), a PNL Computer User Account Request, PNL form A-1020-003 must be completed. This form may be obtained from EDM. In addition, a Computer Project Request Form, Figure 1, must be completed to gain project access.

6.4 RECORDS

There are no quality assurance records generated by this EII.

The following nonrecord material will be handled as specified:

1. The completed PNL Computer User Account Request forms will be maintained by the HEIS Sequent Computer System Manager.

2. The Completed Computer Project Request forms will be maintained by the Project Account Manager.

7.0 REFERENCES

WHC-CM-7-7, Environmental Investigation and Site Characterization Manual.
EII 1.1, "Technical Data Management."
EII 5.1, "Chain of Custody."

WHC-EP-0372, Hanford Environmental Information System (HEIS) User's Manual.

WHC-SP-0660, Hanford Environmental Information System (HEIS) Operator's Manual.

Figure 1. Computer Project Request Form. (A-6000-783)
(sheet 1 of 2)

COMPUTER PROJECT REQUEST FORM

Project Information

Name ____________ (8 characters maximum) Work Package/Order No. ____________

System(s) ____________

Project Account Manager Information (User with management privilege)

Last Name ____________ First Name ____________ MI ______

Personal Account ____________

Authorized Project Users

		Management Privilege
Last Name ____________	Personal Account ____________	☐
Last Name ____________	Personal Account ____________	☐
Last Name ____________	Personal Account ____________	☐
Last Name ____________	Personal Account ____________	☐
Last Name ____________	Personal Account ____________	☐

(NOTE: A current user account is needed for each of the above on each system)

Project Account Manager Acknowledgement of Restrictions and Responsibilities

I have read, initialed, understand, and agree to conform to the Restrictions and Responsibilities regarding management and use of a PNL computer project as stated on the back of this request.

Signed ____________ Date ____________

Designated PNL Point of Contact (PNL Project Manager)

Last Name ____________ First Name ____________ MI ______

Org Code ________ Payroll No. ________ Project Expiration Date ____________

Signed ____________ Date ____________

Database Access Needed (IRM, HEIS)?

☐ Yes ☐ No (If "yes" attach database access request form.)

COMPUTER CENTER USE ONLY

Date Opened ____________ By ____________

Date Closed ____________ By ____________

Notes:

A-6000-783 (08/91)

Figure 1. Computer Project Request Form.
Statement of Restrictions and Responsibilities.
(A-6000-783R) (sheet 2 of 2)

STATEMENT OF RESTRICTIONS AND RESPONSIBILITIES

This PNL project account is assigned to you, the project manager. Through this project you are allowed certain project access privileges and control of specific resources. With these privileges, however, are associated certain restrictions and responsibilities.

SYSTEM USE RESTRICTIONS ____________ (initial)
Computer systems within PNL are divided into two general categories: computer systems specifically approved for classified work and computer systems which are not approved for classified work. In addition, an unclassified computer system may be described as sensitive if the equipment, software, or data are sensitive. Pacific Northwest Laboratories multi-user computers may be used for unclassified or sensitive unclassified processing; DO NOT process classified information on PNL multi-user computer systems.

Pacific Northwest Laboratories computing equipment is to be used only for approved official business. It is not to be used for any personal application including, but not limited to, games, home finances, or personal business. Misuse of such equipment, or providing assistance to others for such purposes, may result in disciplinary action, criminal prosecution, and/or loss of employment. Exceptions to this policy are sometimes allowed for purposes related to an employee's professional education. All such exceptions must have written approval in advance from the employee's supervisor and the system manager.

SECURITY AWARENESS ____________ (initial)
Pacific Northwest Laboratories multi-use computer systems are presumed to process sensitive unclassified information. Although your application may not be considered sensitive, you have a shared responsibility to protect the sensitive information of other users. All users are obligated to report immediately to the system manager or the PNL Computer Program Manager (CPPM) any extraordinary or suspicious activity or suspected violations of system use restrictions.

Most vendor and PNL developed source codes, documentation, and executable images on PNL computer systems are subject to export restrictions. You are responsible to exercise prudence in the use of these codes and documentation and to protect them from disclosure or export.

PROJECT MANAGER RESPONSIBILITIES ____________ (initial)

- As project manager you can grant or remove project access for any user having an account on the system. It is your responsibility to see that access is deleted for any project users no longer needing access.
- The project manager is responsible to see that project users are not wasteful of computer resources and to periodically audit disk usage and purge files where necessary.
- As project manager you should familiarize yourself with the proper use of the computer system. Obtain system specific and PNL documentation from the ISD Customer Service Center. Watch the system login notices for timely updates and announcements.
- Manage the computer resources assigned to you wisely. In particular, keep your disk directories cleaned up by archiving and deleting files not currently needed online.
- Notify the system manager whenever you have problems using any feature of the system. Do not assume that the system manager is already aware of the problem.
- Notify the IDS Customer Service Center of any work package or cost code changes immediately. By your signature on this form, you are authorizing charges against the listed work package for all resources used by this project.

IRM MANAGER RESPONSIBILITIES ____________ (initial)
Project accounts on the IRM Sequent System that include Strictly Private or Business Sensitive files must have the approval of the designated Information Trustee prior to your granting access for any user having an account. It is your responsibility to see that access is deleted for any project users no longer needing access.

A-6000-783R (08/91)

TITLE:

SAMPLE PACKAGING AND SHIPPING

Approved by

W. H. Price, Manager
Environmental Field Services

1.0 PURPOSE

This Environmental Investigations Instruction (EII) establishes packaging and shipping requirements and guidelines to ensure that samples shipped for analysis will be transported *in a manner that* protects the *sample* integrity.

2.0 SCOPE

This EII applies to samples collected during environmental investigations.

3.0 DEFINITIONS

Not applicable.

4.0 RESPONSIBILITIES

The Field Team Leader and sampler(s) are responsible for compliance with this EII and for ensuring that laboratory analysis of samples is coordinated through the *Hanford Analytical Services Management (HASM)*.

5.0 REQUIREMENTS

5.1 CONTROLLED MANUALS

The following controlled manuals are applicable to sample packaging and shipping activities and must be available to the Field Team Leader.

1. WHC-CM-2-3, Property Management Manual, Section 6.4, "Offsite Movement of Property."

2. WHC-CM-2-14, Hazardous Material Packaging and Shipping, Part III, "Nonradioactive Hazardous Materials/Hazardous Waste (HM-HW) Shipments," and Part IV, "Radioactive Material Shipments."

3. WHC-CM-4-10, Radiation Protection Manual, Section 9.0, "Radiological Control of Materials and Equipment."

5.2 SPECIAL EQUIPMENT AND CONTROLLED FORMS

The following are to be available for implementation of this EII:

1. Off-Site Property Control form (54-3000-479). Used by WHC Transportation Logistics and Shipping for shipment of nonhazardous material. See WHC-CM-2-3, Section 6.4, for instructions on use.

2. Hazardous Material Shipment Record form (54-3000-596). Used by WHC Transportation Logistics and Shipping for shipment of hazardous material. See WHC-CM-2-14, Part III, for instructions on use.

3. Offsite Radioactive Shipment Record form (54-6000-088). Used by WHC Transportation Logistics and Shipping for shipment of radioactive material. See WHC-CM-2-14, Part IV, Section 3.3, for instructions on use.

4. Radioactive Materials Shipping Checklist (BD-7800-009). Used by WHC Transportation Logistics and Shipping for shipment of Type A and Type B radioactive shipments. See WHC-CM-2-14, Part IV, for instructions on use.

5. Onsite Radioactive Shipment Record form (54-3000-609). Used to ship radioactive material onsite. See WHC-CM-2-14, Part IV, Section 1.3, for instructions on use.

6. Onsite Routine Radioactive Shipment Record form (WHCM 8708-002.1 and WHCM 8708-002.2). Used to ship radioactive material onsite. See WHC-CM-2-14, Part IV, Section 1.4, for instructions on use.

   NOTE: WHC Transportation Logistics will specify type of onsite radioactive shipment record to use.

7. Sample Analysis Request (A-6000-406 or analytical laboratory-supplied form). See EII 5.2 for instructions on use.

8. Chain of Custody form (A-6000-407 or an analytical laboratory-supplied form). See EII 5.1 for instructions on use.

9. Shipping containers (plastic coolers, cardboard shipping boxes, shielded boxes, U.S. Department of Transportation [DOT]-approved metal cans, etc.), transportation labels and stickers. The WHC Transportation Logistics will specify shipping containers, labels and stickers, etc., as required.

10. Plastic bags (various sizes) and tape (e.g., duct tape, strapping tape, evidence tape and "white" tape).

11. Absorbent packing material (e.g., "insulating" vermiculite).

12. "Fresh" water ice or frozen coldpacks (blue ice) if needed.

13. "Bubble wrap" or equivalent cushioning material.

6.0 PROCEDURE

NOTE: Coordinate with Health Physics on the total activity/specific activity requirements for samples being sent offsite in accordance with WHC-CM-4-10, Section 9.0.

Samples received by WHC Shipping by 13:00 hours will minimize shipping delays.

6.1 PACKAGING AND SHIPPING (NONHAZARDOUS) BACKGROUND SAMPLES

This section presents guidelines and requirements to properly package and ship nonhazardous (background) samples. Always follow the guidance given by WHC Transportation Logistics regarding packaging of sample shipments. If there is a discrepancy between their guidance and this EII, follow Transportation Logistics requirements.

NOTE: Steps with the character **(G)** are guidelines, and steps with the character **(R)** are requirements. They should be performed in the order most logical to fit individual project needs.

1. **(G)** Prior to sampling (at least 1 week), contact WHC Transportation Logistics and supply them with the following information to enable them to recommend the proper shipping container for the samples:

   a. Sample media.

   b. Approximate number of samples to be shipped per day and size (volume/weight) of individual sample or sample containers.

2. After sampling is performed, do the following substeps:

   a. **(R)** Label and seal (evidence tape, dated and initialed) each sample container.

   b. **(G)** Place the sample container in a plastic bag and seal.

3. **(G)** Place sample(s) in shipping container lined with plastic.

4. **(R)** Place fresh water ice or frozen coldpacks (blue ice) in the container, if cooling is required. *Ensure that the sample bottle labels are protected from the ice water within the ice chest in such a way that they will not fall off the bottle during sampling and transport.*

5. Pack sample(s):

   a. **(G)** with enough compatible and absorbent cushioning material (e.g., insulating vermiculite)

5. Pack sample(s):

   a. (G) with enough compatible and absorbent cushioning material (e.g., insulating vermiculite)

   b. (R) by covering all exposed glass or other fragile container surfaces with bubble wrap.

6. (G) Seal plastic liner bag of the DOT-approved shipping container.

7. (R) Complete the following forms. Ensure sample numbers on the forms match the samples in the shipping container.

   a. Sample Analysis Request (SAR).
   b. Chain of Custody.

   NOTE: If samples are being delivered to an offsite or onsite laboratory via a U.S. Department of Energy (DOE) vehicle, omit remainder of Section 6.1 and deliver samples and documentation to the laboratory.

   c. Off-Site Property Control (OSPC).

8. (G) Write "NEXT DAY SERVICE" on the OSPC form to ensure overnight delivery, if required.

9. (R) Have the Health Physics Technician (HPT) sign the OSPC form with an unconditional release.

10. (R) Take the shipping container with samples and documentation to WHC Shipping (1100 Area).

11. (G) Obtain serial number from WHC Property Management, and write this number on the Chain of Custody form.

12. (R) Obtain from WHC Shipping the Bill of Lading/Airbill number for sample shipment. Write this number on the OSPC form. On the OSPC form, indicate the type of compatible and absorbent cushioning material used, and enter the sample numbers in the description block.

13. (R) Request that WHC Shipping includes the shipping container number on the Bill of Lading/Airbill. Sample numbers can be added to an addendum page if an Airbill is used.

14. (R) Complete the "Relinquished by:" block on the COC form.

15. (R) Make copies of documentation for HASM.

16. (R) Place the SAR, Chain of Custody forms, and any associated radiological screening reports, total activity report or HPT documentation in a sealed plastic bag and place inside a DOT-approved shipping container.

17. (R) Secure and seal (e.g., strapping tape) the shipping container lid; then place evidence tape (dated and initialed) on container.

18. **(R)** Place address sticker, "This Side Up" sticker and "Packed in Wet Ice" sticker (if samples are cooled) on top of shipping container. Water ice and blue ice are both considered "wet ice" by WHC Shipping.

19. **(R)** On the OSPC write "Relinquished by" in the "Originated by" block, and then print and sign your name. Enter the date and time in the date block. Obtain the signature, date and time from the WHC shipping recipient in Part II of the OSPC form. Give the OSPC form and the shipping container to the WHC shipping recipient, who will ultimately transfer the container to a carrier for offsite transportation.

20. **(R)** Transmit copies of the Chain of Custody, Sample Analysis Request, shipping documentation, and radiation documentation to the *HASM (plant mail T6-08 or telefax 3-3992) for sample tracking purposes* by the close of business the working day following sample shipment.

    NOTE: Notify (verbal/telecon is acceptable) the HASM of samples shipped to offsite laboratories on the day before a weekend or holiday. If required documentation has been sent to HASM via telefax, a second notification (verbal/telecon) <u>is not required</u>.

6.2 PACKAGING AND SHIPPING HAZARDOUS NONRADIOACTIVE SAMPLES

This section presents guidelines and requirements to properly package and ship hazardous, nonradiological (or potentially hazardous) samples. Always follow the guidance given by WHC Transportation Logistics regarding packaging of sample shipments. If there is a discrepancy between their guidance and this EII, follow WHC Transportation Logistics requirements.

NOTE: Steps with the character **(G)** are guidelines, and steps with the character **(R)** are requirements. They should be performed in the order most logical to fit individual project needs.

1. **(G)** Prior to sampling (at least 2 weeks), contact WHC Transportation Logistics and supply them with the following information in order for them to determine the DOT packaging, labeling and shipping requirements for the samples:

   a. Sample media.

   b. Suspected or potential sample constituents and hazards (if known).

   c. Approximate number of samples to be shipped per day and size (volume/weight) of individual sample or sample containers.

NOTE: If samples are to be delivered to the laboratory via private carrier, go to step 2. Otherwise, omit step 2 and go to step 3.

2. **(G)** Notify WHC Transportation Logistics at least 1 week prior to sampling in order for them to schedule coverage and authorize shipment for any hazardous samples being shipped offsite.

3. After sampling is performed, do the following substeps:

   a. **(R)** Label and seal (evidence tape, dated and initialed) the sample container.

   b. **(G)** Place the sample container in a plastic bag, and seal the bag.

4. **(G)** Place sample(s) in primary shipping container (as specified by WHC Transportation Logistics) that has been lined with a plastic bag.

   NOTE: **(R)** Sample container openings must be facing <u>up</u> inside shipping container.

NOTE: Each sampling project involving hazardous materials will have packaging parameters that will be determined by its associated hazards. The following is <u>one example</u> of how to prepare a sample (chemical analysis) for shipping:

   a. Place individually containerized, bagged, and sealed samples into a plastic bag and seal.

   b. Place this bagged set of samples, with sample container openings facing <u>up</u> (R), into a DOT-approved primary shipping container that has been lined with a plastic bag; place fresh water ice sealed in plastic or frozen coldpacks (blue ice) *in the container*, if cooling is required; then seal the liner bag.

   c. Fill the primary shipping container with compatible and absorbent cushioning material (e.g., "insulating" vermiculite) if necessary.

   d. Tightly seal the primary shipping container. Place labeling as required by WHC Transportation Logistics (DOT specified) on the container.

   e. Place the primary shipping container(s) into a plastic cooler that has been lined with a plastic bag.

   f. *Place fresh water ice sealed in plastic bags or frozen coldpacks (blue ice) in the container, if cooling is required.*

g. Pack plastic cooler with enough compatible and absorbent cushioning material to minimize the possibility of sample damage. *Glass and other fragile and readily breakable containers shall be covered on all sides with bubble wrap.*

h. Seal the plastic liner bag.

i. Close the plastic cooler lid.

5. (R) Place labeling and markings as required by WHC Transportation Logistics on shipping container.

6. (R) Complete the following forms. (Ensure sample numbers on the forms correspond to the sample numbers listed on the bottle labels.)

   a. Sample Analysis Request (SAR).
   b. Chain of Custody.
   c. Hazardous Material Shipment Record (HMSR). (Quantity of material should be written in milliliters for liquids and grams for solids.)

   NOTE: A "certified shipper" is required to certify the HMSR form prior to moving the samples from the sampling location. If the samples are to be shipped "off the Hanford Site," the "authorized shipper" shall be a Transportation Logistics person (WHC-CM-2-14, Part II and Appendix A).

   1. Write "NEXT DAY SERVICE" on the HMSR form to ensure overnight delivery, if required.

   2. Have the HPT sign the HMSR form with an unconditional release.

   NOTE: If samples are being delivered to an offsite or onsite laboratory via a DOE vehicle, omit the remainder of Section 6.2 and deliver the samples and documentation to the laboratory.

7. (R) Obtain from WHC Transportation Logistics the Bill of Lading/Airbill number, if necessary, for the sample shipment. Write this number on the HMSR form. Indicate the type of compatible and absorbent cushioning material used, and enter the sample numbers in the description block.

8. (R) Request that WHC Transportation Logistics includes the sample numbers and shipping container number on the Bill of Lading/ Airbill. Sample numbers can be added to an addendum page if an Airbill is used.

9. (R) Complete the "Relinquished by:" block on the Chain of Custody form.

10. (R) Make copies of the documentation for HASM.

11. (R) Place the SAR, Chain of Custody forms, and any associated radiological screening reports, total activity report or HPT documentation in a sealed plastic bag, and place inside the DOT-approved shipping container.

12. (R) Secure and seal (e.g., strapping tape) the shipping container, and then place evidence tape (dated and initialed) on the container.

13. (R) Take shipping container and documentation to WHC Shipping in the 1100 Area.

14. (R) Obtain the signature of the WHC "authorized shipper" on the appropriate line of the HMSR form, and turn the shipping container and documentation over to WHC Shipping.

15. (R) Transmit copies of the Chain of Custody, Sample Analysis Request, shipping documentation, and radiation documentation to the HASM (plant mail T6-08 or telefax 3-3992) for sample tracking purposes by the close of business the working day following sample shipment.

    NOTE: Notify (verbal/telecon is acceptable) the HASM of samples shipped to offsite laboratories on the day before a weekend or holiday. If required documentation has been sent to HASM via telefax, a second notification (verbal/telecon) <u>is not required</u>.

6.3 PACKAGING AND SHIPPING RADIOACTIVE OR MIXED SAMPLES

This section presents guidelines and requirements to properly package and ship radioactive or mixed samples. Always follow the guidance given by WHC Transportation Logistics regarding packaging of sample shipments. If there is a discrepancy between their guidance and this EII, follow WHC Transportation Logistics requirements.

NOTE: Steps with the character (G) are guidelines, and steps with the character (R) are requirements. They should be performed in the order most logical to fit individual project needs.

1. (G) Prior to sampling (at least 3 weeks), contact WHC Transportation Logistics and supply them with the following information in order for them to determine the DOT packaging, labeling, and shipping requirements for the samples:

    a. Sample media.

    b. Suspected or potential sample constituents and non-radiological hazards (if known).

    c. Estimated or actual curie content of sample(s).

d. Approximate number of samples to be shipped per day and size (volume/weight) of individual sample or sample containers.

NOTE: If WHC Transportation Logistics determines from the above information that an Onsite Routine Radioactive Shipment Record (ORRSR) is needed for onsite sample transportation instead of an Onsite Radioactive Shipment Record (RSR), go to step 2. Otherwise, omit step 2 and go to the NOTE statement following. The ORRSR and RSR are used only when the final destination of samples is onsite.

2. (R) Prior to sampling, obtain an ORRSR in accordance with Part IV, Section 1.4, of WHC-CM-2-14.

NOTE: If samples are to be delivered to the laboratory via private carrier, go to step 3. Otherwise, omit step 3 and go to step 4.

3. (G) Notify WHC Transportation Logistics at least 2 weeks prior to sampling in order for them to schedule coverage and authorize shipment for all radioactive and mixed samples being shipped offsite.

4. After sampling is performed do the following substeps:

   a. (R) Label and seal (evidence tape, dated and initialed) the sample container.

   b. (G) Place the sample container in a plastic bag, and seal the bag.

NOTE: Actual packaging of samples for shipment may be similar to the example given in Section 6.2 of this EII. For shipment of mixed or radioactive samples, the Field Team Leader or designated field team member must work closely with WHC Transportation Logistics and Shipping to properly package these samples.

5. (R) After packaging of samples, fill out the following forms. (Ensure sample numbers on forms match samples in the shipping containers.)

NOTE: A "certified shipper" is required to sign off on a RSR, if used, and on an ORRSR (form WHCM-8708-002.2), if used, prior to the samples being moved from the sampling location. The samples shall meet smear and dose rate limits in conjunction with the HPT signing the radioactive shipment records. If the samples are being shipped offsite, the "authorized shipper" shall be a WHC Transportation Logistics person.

   a. Sample Analysis Request (SAR).

   b. Chain of Custody.

c. Onsite Radioactive Shipment Record (RSR), when required, in accordance with WHC-CM-2-14, Part IV, Section 1.3. Use this form only for onsite shipments to the lab.

d. Onsite Routine Radioactive Shipment Record (ORRSR), when required, in accordance with WHC-CM-2-14, Part IV, Section 1.4. Use this form only for onsite shipments to the lab.

e. Offsite Radioactive Shipment Record (ORSR), when required, in accordance with WHC-CM-2-14, Part IV, Section 3.3, and WHC-CM-4-10, Section 9.0.

1. Write "NEXT DAY SERVICE" on the ORSR form to ensure overnight delivery, if required.

2. Have the HPT sign the ORSR form.

6. (R) Place labeling and markings as required by WHC Transportation Logistics on shipping container.

NOTE: If samples are being delivered to an offsite or onsite laboratory via DOE vehicle, omit remainder of this section and deliver samples and documentation to the laboratory.

7. (R) Obtain from WHC Transportation Logistics the Bill of Lading/Airbill number for the sample shipment. Write this number on the ORSR form. On the ORSR form indicate the type of compatible and absorbent cushioning material used and enter the sample numbers in the description block.

8. (R) Request WHC Transportation Logistics to include the sample numbers and shipping container number on the Bill of Lading/ Airbill. Sample numbers can be added to an addendum page if an Airbill is used.

9. (R) *Complete* in the "Relinquished by:" block on the Chain of Custody form.

10. (*R*) Make copies of *documentation for HASM.*

11. (R) Place the SAR, Chain of Custody forms, and any associated radiological screening reports, total activity reports or HPT documentation in a sealed plastic bag, and place inside a DOT-approved shipping container.

12. (R) Secure and seal (e.g., strapping tape) the shipping container lid; then place evidence tape (initialed and dated) on the container.

13. (R) Take the shipping container with samples and documentation to WHC Shipping in the 1100 Area.

14. (R) Obtain the signature of the WHC "authorized shipper" on the appropriate line of the ORSR form, then turn shipping container and documentation over to WHC Shipping.

15. (R) Transmit copies of the Chain of Sustody, Sample Analysis Request, shipping documentation, and radiation documentation to the *HASM (plant mail T6-08 or telefax 3-3992) for sample tracking purposes* by the close of business the working day following sample shipment.

    NOTE: Notify (verbal/telecon is acceptable) the HASM of samples shipped to offsite laboratories on the day before a weekend or holiday. If required documentation has been sent to HASM via telefax, a second notification (verbal/telecon) is not required.

6.4 RECORDS

The records generated as a result of implementing this EII have records retention requirements specified in interfacing EIIs or the company procedures *shown in Section 5.2*, e.g., records transmittal requirements for the Chain of Custody form are specified in EII 5.1. At the Field Team Leader's option, copies of the records generated *should* be retained for *the project file*.

7.0 REFERENCES

WHC-CM-2-3, Property Management Manual, Section 6.4, "Offsite Movement of Property."

WHC-CM-2-14, Hazardous Material Packaging and Shipping Manual.

WHC-CM-4-10, Radiation Protection Manual, Section 9.0, "Radiological Control of Materials and Equipment."

WHC-CM-7-7, Environmental Investigations and Site Characterization Manual.
EII 5.1, "Chain of Custody."
EII 5.2, "Soil and Sediment Sampling."

8.0 BIBLIOGRAPHY

WHC-CM-1-3, Management Requirements and Procedures, MRP 5.20, "Packaging and Transportation of Hazardous Materials."

TITLE:

WELL SERVICES SUPPORT

Approved by

J. W. Cammann

J. W. Cammann, Manager
Environmental Services

1.0 PURPOSE

This Environmental Investigations Instruction (EII) provides instructions and requirements for performing resource protection well services.

2.0 SCOPE

This EII applies to all resource protection well services tasks required to preserve the ability of a well to (1) meet Data Quality Objectives (DQOs) and (2) support the taking of regulatory compliance measurements. It also applies to those well services required to support hydrologic and vadose testing, and well construction, remediation and decommissioning activities.

3.0 DEFINITIONS

See the Glossary/Acronyms section of this manual.

4.0 REQUIREMENTS

4.1 Training

1. Personnel performing activities shall be trained and qualified in accordance with EII 1.7 and shall be familiar with the applicable safety documents and permits.

2. The cognizant engineer shall ensure that a copy of each applicable safety document and permit is retained at the well site while work is being conducted.

4.1.1 Operating pump setting rigs

1. Before operating a pump-setting rig, personnel must complete and document 3 months of on-the-job training or have 1 year prior experience as a drilling, workover, or pump setting rig operator.

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*This is a total rewrite; therefore, no revision bars are used to indicate changes.

a. The performing organization shall maintain documentation of the completion of these requirements.

2. Operating manuals shall be available at all times during operation.

4.2 Working Safely

1. At all times, every employee must exercise the utmost care and good judgement and conform to the Master Safety Rules.

2. The planning process (Section 5.2 of this procedure) addresses the safety requirements that apply to well service tasks (WHC-CM-4-3, Volume 1, Standard A-3).

3. Every reasonable effort shall be taken to assess and report physical, chemical, and/or radiological hazards that may be encountered during field activities. Such assessment(s) may include the following:

   a. A review of groundwater analysis data or Waste Information Data System (WIDS)

   b. Personnel interviews and process knowledge.

4. In addition to applying good judgement and common sense, personnel shall know and conform to task-specific safety requirements including the following.

   a. A multipurpose fire extinguisher and a shovel shall be available at the work site.

   b. Personnel shall avoid direct contact with contaminated materials.

   c. DO NOT chew, smoke, eat, or drink in contaminated areas. Avoid hand to face contact.

   d. Personnel shall always use an appropriate level of personal protection.

   e. A 2-way radio and/or cellular telephone shall be provided at each site for use in emergencies.

   f. When it is appropriate, personnel shall use the buddy system.

   g. All personnel shall look before they act.

      - Be aware of your own and others' position in relation to moving equipment (e.g., cat heads and U-joints).

- Use extreme caution when assembling, disassembling, lifting, and carrying tools and equipment, to avoid collisions and pinch-point injuries.

h. Tools and equipment shall be kept off the ground whenever possible to prevent tripping hazards and the spread of contamination.

i. Work shall take place only during daylight hours unless the entire work area is adequately illuminated.

j. Upon completing activities and before eating or placing anything in the mouth, personnel shall thoroughly wash hands and face.

4.2.1 Personal protective equipment

1. Health and Safety personnel shall be consulted to ensure proper engineered and administrative controls, personal protective equipment, and monitoring instrumentation requirements have been identified.

2. Additional required PPE may be specified by the radiation work permit (RWP), safety documentation, or health and safety personnel, but <u>the following personal protective equipment (PPE) shall be worn at a minimum</u>:

   a. Steel toe work shoes
   b. Cloth coveralls (Blues)
   c. Appropriate work gloves
   d. Cold weather clothing as appropriate
   e. Safety glasses.

   The following shall be worn when working near a pump setting (or other) rig:

   f. Hard hat.

4.2.2 Safety meetings

1. All team personnel shall attend a prejob safety meeting and daily tailgate safety meetings.

   a. The prejob meeting need only occur before the start of a long-term program (e.g., well cleaning program).

   b. Daily tailgate safety meetings shall be held before the day's activities begin and shall address safety issues pertaining to the tasks that will be performed.

   c. Document safety meetings on the field activity report.

4.2.3 Equipment safety inspections

1. Before using any powered equipment, the operator shall conduct a safety inspection to ensure that the equipment is in good working condition and that all safety devices (e.g., belt guards and emergency shut-offs) are in place and operable.

2. The operator shall also conduct a weekly rig safety inspection. Document the safety inspection on the appropriate field activity report.

4.2.4 Chemical hazards

1. When chemical materials are handled or used in conducting well service activities, personnel shall follow the required protection methods described on the applicable Material Safety Data Sheet (MSDS).

2. During prejob planning, chemical hazards that may be encountered in or around wells and groundwater shall be identified based on groundwater analysis data and process knowledge.

4.2.5 Physical hazards

1. Well service personnel shall prepare for and respond appropriately to Hanford Site physical hazards including:

   a. Severe weather and temperature extremes.

   b. Fire hazards.

   Proper responses include the following:

   c. Cease work until severe weather subsides.

   d. Wear clothing appropriate for conditions.

   e. Take frequent breaks and drink water in the event of heat stress.

   f. Use caution when driving to and from work sites, especially during fire season.

   g. Promptly report fires by calling 911.

4.2.6 Biological hazards

1. Personnel must be aware of biological hazards including rattlesnakes, scorpions, and black widow spiders and exercise caution and good sense.

4.2.7 Radiological hazards

1. All work within radiation areas shall be performed in accordance with WHC-CM-1-6.

2. All personnel conducting well service activities shall read, and perform work in accordance with, the governing RWP.

3. If a RWP for a specific radiation site is not appropriate for the work being performed, a new RWP shall be prepared and signed.

4. To help Health Physics determine how much technician coverage is necessary, the cognizant engineer shall provide the most current water analysis data to Health Physics during prejob planning.

   a. Either (1) Health Physics management decision (based on the RWP) or (2) well services field team request determines the amount of Health Physics Technician coverage.

4.2.8 Unique/uncharacteristic hazards

1. The cognizant engineer shall conduct a one-time walk-through inspection of the well site before the site is entered and work activities commence (before equipment is mobilized and personnel begin work). The purpose is to identify unique/uncharacteristic hazards (e.g., confined space entry, cave-in potential, surface subsidence).

2. If hazardous or potentially hazardous conditions exist, the cognizant engineer may need to complete a Job Hazard Analysis (JHA) before the site is entered and work commences.

4.2.9 Safety requirements when working within a designated hazardous waste site

1. When personnel are performing maintenance activities on resource protection wells located within designated hazardous waste sites, site-specific health and safety document(s) apply.

4.2.10 Off Road Vehicle Travel

Vehicles shall only be driven off-road from established hard surfaced roads when required by job assignment. Adverse impact to the environment shall be kept to a minimum. Vehicles equipped with catalytic converters shall not be parked over dry grass or brush. Vehicles for off-road use shall be equipped with the following:

- Mufflers equipped with spark arrestor
- Radio transmitter/receiver or cellular phone
- Fire extinguisher
- Shovel
- Headlights and taillights for dusk/night use.

4.2.11 Cutting/Welding/Open Flame Work

Tasks involving welding, cutting, or open flame will be conducted in accordance with WHC-CM-4-41, Section 5.1 and Section 5.3. A cutting/welding permit (A-6000-895.1) shall be completed for each job. If the job remains inactive for longer than one shift, the permit shall be reviewed and re-initial prior to each restart of cutting/welding operations to verify that site and job conditions have not changed. Each new job supervisor, fire watch, and welder shall also review and initial the permit.

4.2.12 Work stoppage

1. In the event of an immediately dangerous or life-threatening situation, any employee has the authority and responsibility to temporarily stop work.

    a. The employee must then immediately notify the Field Team Leader, the immediate manager, and if applicable, the Site Safety Officer and the Health Physics Technician.

2. Work must stop if any changes occur or unexpected events happen that threaten employee health and safety.

3. Work must stop if any required hazardous material or radiation monitoring equipment is not on hand and working properly.

4. The cognizant engineer, Site Safety Officer, Health Physics Technician, and/or any other personnel deemed necessary will meet to discuss work stoppages and to resolve issues.

4.3 Regulatory Compliance

1. If a well meets both of the following objectives, it shall be considered compliant and functional:

    a. Meets data quality objectives

    b. (If it's a resource protection well) it can provide regulatory compliance (RC) measurements including groundwater turbidity and groundwater levels and can provide groundwater samples.

2. Service performed on existing wells shall comply with WHC internal compliance requirements, which are based on applicable portions of the following regulatory documents:

    a. WAC 173-160, "Minimum Standards for Construction and Maintenance of Water Wells."

    b. WAC 173-162, "Regulation and Licensing of Well Contractors and Operators."

c. OSWER Directive 9950, "RCRA Groundwater Monitoring Technical Enforcement Guidance Document."

d. Operable unit work plans, groundwater monitoring plans, and letters approved or issued by Regulatory agencies providing guidance and policy for use of specific existing wells. The DQOs are normally provided in these documents.

4.4 Equipment and Tools

1. Every tool and piece of equipment shall be visually inspected prior to use to ensure it is in good operating condition and can support activities.

2. The equipment needed varies with specific well and well site conditions and the tasks to be performed.

   a. The pump setting rig (e.g., Smeal[1] 3T and 5T) is used in most well service activities.

3. All equipment shall be operated in accordance with the manufacturer's operating manual(s).

5.0 PROCEDURE

5.1 Requesting and Documenting Well Services Using the Well Services Request

Any Individual or Organization	1. Request well services using the Well Services Request form BC-6000-316.
	a. Use the Well Services Request (WSR) to report or document well conditions that (1) restrict or prevent the taking of RC measurements, (2) prevent the well from meeting requirements for DQOs, (3) are otherwise noncompliant, or (4) prevent the well from meeting functional requirements (e.g., security) or program goals.
	b. This form tracks requests made and response action(s) taken.
Performing Organization	c. Assign each WSR a unique number to facilitate tracking from generation to closure.

[1] Smeal Manufacturing Company, Snyder, NE.

Cognizant Engineer

d. Once service has been performed, record the disposition on the WSR, and return an informational copy to the requesting organization.

5.2 Planning

5.2.1 Prioritizing well service activities

Performing organization manager or designee

1. Prioritize well service activities and assign a priority level based on the following:

   - Immediate hazards to the environment and/or public health and safety.
   - Impacts to the collection of RC measurements.
   - Well fitness-for-use evaluations.

<u>Priority 1</u>:

a. Well or well site conditions present an immediate hazard to the environment and/or public health and safety.

b. Well conditions prevent the collection of RC measurements within scheduled time frame.

c. Well or well site conditions present an immediate impact to ongoing programs involving subject well(s).

<u>Priority 2</u>:

a. Well or well site conditions present a potential hazard to the environment and/or public health and safety.

b. Well conditions impede, but do not prevent, the collection of RC measurements.

<u>Priority 3</u>:

a. Well or well site conditions do not meet RC functional requirements, but do not impact the collection of RC measurements.

b. Any well or well site conditions not designated Priority 1 or 2.

NOTE: Prioritize and schedule well services requested in work plans or other controlling documents according to program needs and milestones. However, Priority 1 items must always take precedence.

Scheduling and performing any activity is always contingent on available resources.

5.2.2 Planning

Cognizant Engineer

1. Plan work and coordinate with other organizations as necessary; assign impact level. Notify well custodians and well users to obtain approval prior to scheduling work.

2. For all well service activities except those listed in Step 3 below, use a Well Services Planning Report, BC-6000-317.1.

   a. Complete a planning report for each specific task or group of tasks to be scheduled and performed at a specific well, group of wells, or well site.

   b. Complete this form before commencing work.

   c. Provide enough detail to allow the field team to conduct the necessary tasks, and/or identify letters of instruction and work order(s) controlling work to be performed by contractors.

Cognizant Engineer

3. Use the Well Services Planning Report when necessary; it does not need to be completed for some minor well service surface tasks. These tasks may be performed and documented on a WSR or other applicable form (activity report or Resource Protection Well Structure Field Inspection Report). The tasks include the following:

   - Conducting field inspections
   - Replacing well cap if welding is not required
   - Marking well with permanent identification number
   - Repairing surface components of sampling pump system (e.g., replacing Hydrostar[2] packing, extending or adjusting Hydrostar

[2] Instrumentation Northwest, Inc., Redmond, WA.

actuating rod, replacing/repairing electric plug, reattaching secondary ground wire)

- Obtaining water level or depth to bottom measurements.

4. Assign personnel to field team.

5.3 Contamination Control

Cognizant Engineer

1. Consider contamination control during prejob planning.

All Personnel

2. Ensure that all materials, tools and equipment placed into a well are clean and do not interfere with the chemical, physical, radiological, or biological constituents of interest for monitoring purposes.

   a. Ensure that new well equipment/tools being installed/used for the first time were previously cleaned (by the manufacturer and packaged in plastic) or cleaned and handled in accordance with EII 5.4 before being used.

5.3.1 Tools and equipment

Field Team

1. While performing work, handle all equipment/tools removed from a well in a manner that minimizes potential spread of contamination.

   a. As a minimum, all equipment that will re-enter (or be reinstalled in) the well must be maintained above the ground surface on pipe stands, trailer bed, wood blocking, or by other means.

   b. Personnel handling the materials/equipment must wear new cotton or latex gloves, or gloves otherwise prescribed in applicable safety or radiation protection documents.

2. All decontamination must be performed and documented in accordance with EII 5.4 and recorded in the field logbook.

3. After completing well service activities, decontaminate tools and equipment that contacted

either groundwater or contaminated soils before using them in another well.

a. Equipment to be reinstalled in the same well need only be decontaminated/cleaned if contamination controls were breached while the equipment was removed from the well or stored on the surface.

5.3.2 Materials

Field Team

1. Pack sand in sacks and cover with plastic.
2. Pack bentonite materials (pellets, granules, or grout) in plastic-lined sacks or 5-gallon plastic buckets and protect from the weather (e.g., cover with plastic, place under shelter, or in buildings) to prevent contamination and water damage before use.
3. Pack gravel in the same manner as the sand, or at least rinse with potable or Columbia River raw water and place in plastic bags or lined drums and seal until use.

5.4 Well Service Activities

Performing Organization

1. Perform, control, or give technical direction for, all activities.

   a. EXCEPTION: End user personnel may perform minor surface well services (e.g., checking pump wiring) to facilitate completion of their activities.

All personnel

2. Document field activities on the appropriate report forms, and control the documentation in accordance with Section 8.0 of this EII.

5.4.1 Surface well service tasks

Surface tasks may include the following:

1. Perform a field inspection and document it on a Resource Protection Well Structure Field Inspection Report form A-6000-499R.
2. Remove debris from the well site.
3. Place/repair protective barrier posts.
4. Place/repair the concrete well pad.

5. Mark the well with an identification number.

6. Survey and mark the well head reference point.

7. Place a brass survey marker.

8. Install locking well cap and lock.

9. Paint the protective barrier post and well head.

10. Repair the well head.

11. Modify above-surface well casing (e.g., extend/shorten, install specialized well head assemblies).

12. Repair the surface components of the sampling pump system.

5.4.2 Subsurface well service tasks

1. A variety of downhole tools may be required including drilling jars, bailers, sand pumps, casing perforators, wire brushes, swab bars, surge blocks, fishing tools, and packers.

2. Subsurface tasks involve entrance into a well. Tasks that may be performed include the following:

   a. Remove, install, and replace pump systems.

   b. Troubleshoot pump systems.

   c. Repair Hydrostar pumps.

   d. Remove objects in the well (e.g., pump system parts or sampling equipment that have fallen into the well).

   e. Conduct borehole TV camera surveys.

   f. Brush the inner walls of casing and/or screen to remove deposits (e.g., silt, scale, rust, algae).

   g. Sand pump/bail the well to clean out sand or other small debris resulting from scrubbing or encroachment into the well.

   h. Perforate the well casing.

   i. Redevelop/work the well to improve aquifer communication and reduce effluent turbidity.

   j. Install telescoping well screen.

k. Shorten the saturated screened or perforated interval within an existing well.

l. Install well packers and bridge plugs.

m. Install/remove downhole testing/monitoring equipment.

n. Install/remove piezometers.

5.4.3 Well rehabilitation

1. Well rehabilitation refers to the restoration of a well to its original condition including well services conducted as part of the preventative maintenance program.

2. Well rehabilitation tasks are also performed during well fitness-for-use activities and when requested by well users.

5.4.3.1 Preventative well maintenance

Preventative well maintenance is conducted on a cyclic schedule. Only wells currently in use for monitoring programs are placed on the schedule. Perform the following tasks as a minimum.

1. Brush and clean well casing and screen/perforations.

2. Sandpump debris and fill to restore well to original depth.

3. Develop the well.

4. Inspect well head, surface pad and posts for damage, and repair accordingly.

5. Repaint well casing and barrier posts.

6. Repaint well number on well casing and barrier post.

To facilitate the above tasks, additional tasks may need to be performed; these will be identified in the associated planning report.

5.4.3.2 Fitness-for-use evaluations

Fitness-for-use evaluations are conducted upon the request of well users. Tasks performed provide information to assist in the evaluation of the fitness of a well for intended use in accordance with EII 6.6. Perform the following tasks as a minimum.

1. Perform field inspections.
2. Conduct television camera survey(s).
3. Brush and clean well casing.
4. Sand pump debris and fill to restore well to original depth.

5. Develop the well.

To facilitate the above tasks, additional tasks may need to be performed. The well user may also request that additional tasks be performed. Document tasks performed for fitness-for-use evaluations on a WSR.

5.5 Well Service Criteria

1. Visual and mechanical verification checks may be performed to determine if the well and well site conditions are in a compliant condition.

2. Report noncompliant conditions in accordance with Section 6.1 of this EII.

3. The following sections provide criteria to be used as an aid to performing well services.

5.5.1 Criteria for surface well/well site service actions

1. Using the left-hand column of the following table, assess the well/well site condition.

2. If appropriate, perform the corresponding well service given in the right-hand column.

Compliant Condition	Well Service Action(s) if Found Noncompliant
1. Well site is free of litter, miscellaneous debris (e.g., tubing, scrap wood).	1. Clean up the site and dispose of the debris appropriately.
2. Well cap is present, undamaged, lockable, and locked.	2. If well cap is missing, provide a replacement. If cap is damaged, repair or replace it. Size the cap to the well head diameter to allow for easy removal and to protect all openings in the casing. Equip the cap and well head with a hasp to allow the well to be secured and locked. If a lock is not present, provide one. Lock the well when unattended.
3. The well head is undamaged (e.g., not dented, broken, or pierced).	3. Repair the well head casing in a suitable manner to return it to a functionally acceptable condition to ensure the security of the well.

Compliant Condition	Well Service Action(s) if Found Noncompliant
4. The well head, cap, and barrier posts (if equipped) can be easily seen (e.g., paint is not faded; not overgrown with vegetation).	4. Paint carbon steel well heads, caps and/or barrier posts with yellow paint. Do not paint stainless steel well heads and caps. • Remove overgrowth of vegetation from around well head. • It may be necessary to identify well location in thick growth with a tall marker pole.
5. Well identification markings are present and clearly visible.	5. Clearly mark well identification numbers on the well head (primary outer casing) and one nonremovable barrier post (if equipped). • Use black paint to stencil numerals/letters 2 to 3 inches high. • Permanently stamp/etch well number on well head. If possible, mark multiple inner casings (e.g., piezometer tubes) similarly.
6. The cement pad is present and undamaged (e.g., not separated from well head, cracked, or broken).	6. Repair/replace the well pad to meet or exceed WAC 173-160-510 requirements.
7. Barrier posts are present and undamaged. • Evaluate need for posts based on well location, potential for well head damage, and potential for safety hazard. • No posts are needed within a controlled crib area.	7. If barrier posts are needed or requested, install posts in accordance with WAC 173-160-510 requirements.

Compliant Condition	Well Service Action(s) if Found Noncompliant
8. Permanent brass survey identification marker is present; survey mark is present and visible on well head casing.	8. Place a permanent brass survey marker in the cement pad, if present, and stamp it with the well identification number. Make a clearly visible survey mark. As a minimum, stamp an "X" in the top edge of the outermost and/or highest well head casing, and stamp a corresponding mark in the side of the casing to indicate the point to which the casing was surveyed. If no mark is present, survey the well in accordance with internal WHC procedures, and mark appropriately.
9. The well head casing is an acceptable height to facilitate RC measurements.	9. Cut off or augment the well head casing as determined by the cognizant end user, to comply with WAC 173-160-510.
10. The electrical plug for an electrical submersible pump is present and undamaged and the secondary ground wire is present and attached.	10. Replace the electrical plug end of the submersible cable; if necessary, attach a secondary ground wire.

5.5.2 Criteria for subsurface well service tasks

1. Using the left-hand column of the following table, assess the well subsurface condition.

2. If appropriate, perform the corresponding well service given in the right-hand column.

Compliant Condition	Well Service Action(s) if Found Noncompliant
1. Well is free from obstructions.	1. Remove steel tapes or E-tapes found stuck in the well. Try to not damage the tapes. • It may be necessary to remove the pump system to retrieve the tape. • If it is known (or reported) that a specific object (e.g., sample bottle, broken tape) has been dropped into the well, retrieve the object. • A borehole TV camera survey may be needed to locate and identify the object and determine the retrieval action. • When installing a pump, if an obstruction inhibits installation, conduct a borehole TV camera survey to identify the obstruction. Perform appropriate tasks to correct/repair the condition. • If unable to remove the obstruction, notify the end user in accordance with Section 5.9.
2. Pump placement is within Environmental Protection Agency's (EPA) technical guidelines (OSWER-9950). Pump intake should be at least 5 feet below the measured water level and at least 2 feet above the measured bottom of the well. Deviations from the above may be required by cognizant end users.	2. Reposition the pump. Bailing/pumping sand from the bottom of the well may be necessary to restore well to original depth for proper pump placement.

Compliant Condition	Well Service Action(s) if Found Noncompliant
3. Electrical components of electric submersible pump system are functional.	3. Wire connections may need to be inspected, cleaned, repaired, and/or secured as appropriate. Other possible necessary actions are as follows: • Repair or replace pump electrical cable. • Replace pump.
4. Pump system operates according to manufacturer's specifications.	4. The pump system may need to be removed from the well and inspected. Correct/repair any problem as appropriate. a. The following conditions may be discovered: • Pump is damaged. • Pump intake is restricted or blocked by debris. • The discharge pipe assembly is cracked, split, corroded, or parted and is not sealing.

Compliant Condition	Well Service Action(s) if Found Noncompliant
4. (cont.)	• There is an obstruction in the discharge pipe assembly. • Hydrostar pump actuating rod assembly is parted or damaged. • One or more cylinder seals or liners in a Hydrostar pump is damaged. • The check valve in the Hydrostar pump is damaged or stuck open. NOTE: If the electric submersible pump is defective, replace it with a new pump of like make/model, unless the cognizant end user directs otherwise. Replace normally expendable Hydrostar parts in accordance with the manufacturer's instructions. If an electric submersible pump removed from a well was manufactured before June 1978, assume the pump capacitor contains PCBs. Replace this pump with an appropriate pump. Disposition defective pumps and pump parts in accordance with applicable procedures and at the direction of the facility generator.

Compliant Condition	Well Service Action(s) if Found Noncompliant
5. Pump discharge rate/volume remains continuous and steady.	5. Perform maintenance tasks given in Step 4, above. If none of the conditions listed in 4a above exist, the cause may be water level drawdown resulting from well screen or casing perforations being partially plugged with scale deposits or a tight aquifer or filter pack. To determine if this condition exists, remove the pump system from the well and conduct a borehole TV camera survey. If the condition exists, perform appropriate corrective tasks, including the following: • Brushing/scrubbing the well casing to clear screen and/or perforations of deposits. • Well development in accordance with Section 5.7.
6. Well effluent meets turbidity guidelines (in accordance with Section 5.7).	6. Develop the well in accordance with Section 5.7.

5.6 Borehole Camera TV Surveys

1. Only the performing organization should operate the camera equipment.

2. Operate the camera equipment in accordance with the manufacturer's operating manual.

3. Document the survey on the Field Activity Report--Borehole Television Survey, BC-6000-419.

   a. A taped recording may be made of the camera survey and maintained for reference purposes.

5.7 Well Development

1. Well development may be a required or requested task. Its purpose is to reduce well effluent turbidity and/or increase aquifer communication.

   a. Turbidity is measured using a turbidity meter (e.g., Hach[3], model 16800).

   b. The turbidity of the well effluent shall not exceed 5 nephelometric turbidity units (NTU).

Cognizant engineer

2. Before beginning well service development tasks, notify the end user.

End user

3. Designate the development specifics such as task/method, data collection requirements, and documentation.

Field Team

4. Develop the well in accordance with the specific method and procedure recorded in the Well Services Planning Report.

   a. Well development may involve surging, swabbing, bailing, constant flow pumping, or a combination of one or more methods.

5. Unless otherwise directed by the cognizant end user, discontinue development activities if any of the following conditions occur:

   a. Excessive intrusion of sand or sediment.

   b. Excessive water level drawdown (e.g., drawdown prevents proper operation of the pump).

   c. Turbidity measurements stabilize at 5 NTU or less.

   d. Purge volume reaches 2,000 gallons.

5.8 Shortening Saturated Screened or Perforated Intervals

1. Because of excessive purge volumes or to meet DQOs, the saturated screened or perforated intervals within existing wells currently being monitored may need to be shortened.

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[3] Hach Company, Loveland, CO.

2. The requesting organization completes and submits a WSR or a user-approved Fitness-For-Use Checklist (EII 6.6, form A-6000-451).

3. This work requires the placement of a temporary plug and must not affect the structural characteristics of the well.

5.8.1 Method for shortening saturated intervals

Field Team

1. Shorten saturated intervals in accordance with the Well Services Planning Report, which contains detailed instructions for the placement of materials. General requirements are include here.

   a. Sand must be the major fill material used to shorten the saturated screened or perforated interval.

   b. Other materials that may be used as part of the plug are bentonite, gravel, and cement.

   c. A depth tag for each layer of material must be made before placing the next layer.

   d. The final tag must be within 1 foot of the newly specified depth of bottom.

   e. Document exact volumes, types, and depths of material placed in the well on the Field Activity Report--Well Services form, BC-6000-278.

   f. Contamination shall be controlled in accordance with Section 5.3 of this EII.

5.9 Notification of Well Service Results

Cognizant Engineer

1. After well service tasks have been completed, inspect and evaluate the well to determine whether it is compliant and/or functional for making RC measurements (Section 5.5) or meeting DQOs.

2. Report results to the requesting organization (Section 5.1) and/or to the cognizant end user(s).

End user

a. If the desired results were not obtained, decide whether

- Further well service will be conducted,
- The well will be used as is, or
- The well will be evaluated for fitness-for-use in accordance with EII 6.6.

6.0 HANDLING PURGEWATER

All water purged from a well during the process of conducting well service tasks shall be handled in accordance with EII 10.3, and documented in the field activity report.

7.0 FLOWING ARTESIAN WELLS

1. Groundwater from flowing artesian wells shall be treated as purgewater in accordance with Section 6.0 of this EII.
2. The well head for flowing artesian wells must be designed to prevent the inadvertent release of purgewater to the ground and take into consideration fluctuations of internal pressures resulting from aquifer use, weather changes, and Columbia River level fluctuations.
3. These wells must be inspected monthly.
   a. Required repairs must be made as soon as possible.

8.0 RECORDS

Records shall be processed and dispositioned in accordance with the following table. All records are to be transmitted on an Environmental Transmittal to the file custodian (FC).

NAME Filing Unit Title or Description	RECORD TYPE*	RETENTION PERIOD	DISPOSAL AUTHORITY	CUT-OFF AND RETIREMENT INSTRUCTIONS
Well Services Request (BC-6000-316); Well Services Planning Report (BC-6000-317.1), Drawing Continuation Page (BC-6000-317.2), Text Continuation Page (BC-6000-317.3); FARs - Borehole Television Survey (BC-6000-419); Well Services (BC-6000-278)	QA	TBD	TBD	Upon completion transmit to FC for submittal to IRM permanent storage per approved RIDS. FC places copy in files maintained by well or project number.
Resource Protection Well Structure Field Inspection Report (A-6000-499)	R	TBD	TBD	Maintained by well services organization for reference until no longer needed.
Borehole camera TV surveys - taped recording(s)	R	Maintain by well services organization for 2 years or until no longer needed.	GRS 21.19	Maintained for 2 years or until no longer needed by well services organization. Destroy or reuse (when practical).

* QA = Quality Assurance; R = Other Record Material; TBD = To be determined

9.0 DESIGNATED REVIEWING ORGANIZATIONS

Organizations designated to review changes to this document are listed below. The controlled manual point-of-contact (CMPOC) listed for the designated reviewing organization(s) is responsible for coordinating the review and consolidating and submitting comments to the originating organization.

Designated Reviewers	CMPOC
Documentation and Records Services	IRM/DRM
Geotechnology	RR/LWD
Projects	EA/Envir

Comments from other organizations are welcome; however, such courtesy comments are resolved at the option of the originating organization.

10.0 FORMS

FAR Borehole TV Survey (BC-6000-419)
FAR Well Services (BC-6000-278)
Resource Protection Well Structure Field Inspection Report (A-6000-499)
Sample Pump Installation (A-6001-035)
Well Services Request (BC-6000-316)
Well Services Planning Report (BC-6000-317.1)
Well Services Planning Report Drawing Continuation Page (BC-6000-317.2)
Well Services Planning Report Text Continuation Page (BC-6000-317.3)

11.0 REFERENCES

OSWER Directive 9950, "RCRA Groundwater Monitoring Technical Enforcement Guidance Document.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Water Wells."

WAC 173-162, "Regulation and Licensing of Well Contractors and Operators."

WHC-CM-1-6, WHC Radiological Control Manual.

WHC-CM-3-5, Document Control and Records Management Manual, Section 5, "Records Storage, Retrieval and Destruction."

WHC-CM-4-3, Industrial Safety Manual.
Volume 1, Safety Standards, Standard A-3, "Prejob Planning."
Standard A-7, "Hazardous and Asbestos Work Permits."

APPENDIX A

INSTALLING/REMOVING ELECTRIC SUBMERSIBLE PUMP

1.0 PURPOSE

This appendix provides instructions for the installation, removal, or repositioning of electric submersible pumps in groundwater resource protection wells.

2.0 REQUIREMENTS

1. This appendix presumes availability of a suitable rig (derrick, winch and support equipment) for hoisting the pump system (pump and discharge pipe). A rig refers to a pump setting rig, drilling rig, or other similar equipment/systems.

2. All hoisting (raising/lowering) of the pump and discharge assembly shall be done using the rig.

3. No grease or other foreign material shall be allowed on any pump system components.

4. The rig shall be set up and operated in accordance with the manufacturer's operating manual.

3.0 PROCEDURE

3.1 Preparing Electric Submersible Pump

1. Before installing pump system components, ensure that all components have been protected from potential contamination (e.g., sealed in plastic, kept in a protected environment).

   a. If components have not been protected from possible contamination, clean each item before installing it in the well, in accordance with Section 5.3 of this EII.

   b. Protect cleaned components from contamination until they are installed in the well, in accordance with Section 5.3 of this EII.

      - Use pipe stands, pallets, and/or plastic sheeting.

      - Only lay out enough lengths of pipe to place the pump at the required depth. Measure all pipe before installation; record on the Field Activity Report - Tubular Goods Tally form (BC-6000-280).

2. Remove the check valve from the pump, if so equipped.

   a. Detach the top section of the pump and remove the check valve.

   b. If further instruction is needed, refer to the manufacturer's pump operating manual.

3. Connect the submersible wire to the 220 volt pump motor as follows:

   a. Strip off a small amount of insulation from the two wires extending from the pump and the three submersible wires.

   b. Separate the three submersible wires sufficiently to install heat-shrink tubing.

   c. Slide shrink tubing sections over each of the two pump wires.

   d. Using wire connector fittings and a crimping tool, connect two of the submersible wires to the pump wires.

   e. Slide the heat shrink tubing over the connector until it is centered; then use a portable electric heat gun to shrink the tubing tightly onto the connector and wires. Begin heating the tubing in the center and work outward. Operate the heat gun in a safe manner in accordance with manufacturer's operating instructions.

   f. Attach the remaining submersible wire to the body of the pump as a ground.

   NOTE: The color or position of the ground connector is important. In most cables, the red and black wires are spliced to the pump and the yellow (or green) wire is used as the ground. Ensure that after the three submersible wires are connected to the pump that all three wires have approximately the same tension when pulled taut (i.e., there is no excess slack in any wire).

4. Attach the appropriate fitting(s) to the pump discharge point to enable the discharge pipe sections to be attached to the pump. The fittings must be made of a corrosion-resistant material.

   a. Use Teflon[4] tape between metal threads to ensure a seal between each of the metal fittings and the pump. Fittings made of a plastic material do not require Teflon tape.

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[4] DuPont Company, Wilmington, Del.

3.2 Installing Pump

1. A lifting plug is required as an interface between the pump rig mainline hook and the pipe sections to be lowered into the borehole.

   a. First thread[5] the lifting plug into the female coupling of the pipe section, tighten, and attach to the safety hook of the rig mainline.

2. Raise the first section of pipe with the rig mainline, tailing it to prevent contact with the ground or damage to the pipe threads, until it is completely suspended in the air. Provide enough clearance between the pipe section and the ground to allow the prepared submersible pump to be centered below the pipe.

3. Lower the pipe section down onto the discharge fittings of the pump and thread the pipe into the fittings by turning the pipe section by hand while it is suspended. The safety hook is designed to swivel; the pipe section should rotate freely while threading the pipe section into the pump. Avoid cross-threading the pipe and fitting.

4. Once a hand-tight fit has been achieved, use two wrenches to make the fit snug[6], but do not overtighten.

5. Raise the pump and pipe section until they are centered over the borehole.

   a. Using plastic cable ties attach the submersible cable to the pipe section(s).

   b. A cable tie should be used as often as necessary to keep the submersible cable tight against the pipe. Use cable ties for pipe sections that will be below water (or could be, if the water table fluctuates).

   c. For pipe sections above the water table, duct tape may be used to secure the cable to the pipe. Pull cable taut, and secure it with 2 or 3 wraps of tape.

6. Lower the first pipe section gently into the well.

7. Guide the pump electric cable into the well as tubing is being lowered to ensure that the cable is not cut or nicked.

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[5]Mating two sets of circular threaded surface (one male, one female) by insertion and rotation until seated.

[6]A condition resistant to being vibrated loose; equivalent to about one-quarter turn beyond hand-tight.

8. Slide the appropriate size landing plate between the pipe coupling and the borehole casing to support the pipe column.

   a. Lower the pipe section until the full weight of the pipe column and pump rests on the landing plate, being sure not to damage submersible wires.

   b. Unthread the lifting plug from the first pipe section.

   NOTE: The landing plate is a plate of metal slotted to fit around the shank of a pipe section. It provides a means of supporting the pump system at a coupling and rests on the top edge of the borehole casing.

9. Retrieve the next pipe section and thread it onto the lifting plug.

10. Attach the lifting plug to the mainline swivel hook and raise the pipe section, tailing the end, until it is lifted slightly above the first section of the pipe.

    a. Lower the section of pipe until the coupled ends meet and thread these ends together by rotating the suspended section of pipe.

    b. Use two pipe wrenches to ensure that the connection is sufficiently tight (snug) and that the section resting on the landing plate does not rotate.

11. Raise the pump system until all weight is removed from the landing plate. Slide the landing plate from its holding position. Again lower the assembly into the borehole.

12. Attach the submersible wires in accordance with Section 3.3, item 5, of this appendix.

13. Guide the submersible wires into the well as tubing is being lowered to ensure that the cable is not cut or nicked.

14. When the pipe coupling for the second section of pipe comes to the top of the borehole, again slide the landing plate between the coupling and the borehole casing to support the pump assembly.

15. Repeat steps 1 through 4 above, until all of the pipe sections have been attached.

3.3 Well Head Pump Support Assembly

1. Use a well seal or pitless adaptor to support the pump system. These support assemblies provide for discharge of effluent pumped through the pipe sections.

3.3.1 Well seal support assembly

1. Connect a pipe nipple to the last section of pipe. The pipe nipple should be approximately 4 in. long and should fit through the center of the well seal. Snug the nipple with wrenches. Slide the well seal over the pipe nipple.

2. Attach a pipe tee fitting to the pipe nipple above the well seal.

3. Cut the submersible wires, leaving approximately 4 feet of excess. Insert the end of the wires through the opening provided in the well seal.

4. Connect a 220 volt plug (with correct blade configuration and ground pin) to the end of the submersible wires. Ensure that the ground wire is connected to the grounding receptacle inside the plug.

5. Insert a second ground wire into the grounding receptacle of the 220 volt plug and through the well seal.

   a. Attach the secondary ground wire to a bolt on the bottom side of the well seal or a place on the well head where electric grounding is assured.

6. Using a lifting plug threaded into the top of the pipe tee, lift the whole pump assembly off the landing plate.

   a. Secure all spare wire tightly to the pipe column with duct tape or cable ties, as appropriate.

7. Lower the well seal until it seats properly inside the borehole casing (the top edge of the well seal is supported by the top edge of the casing).

   a. When all weight has been transferred from the lifting plug to the well seal, unthread the lifting plug and replace with a pipe plug fitting.

8. Tighten the well seal bolts snugly to achieve a tight seal against the casing.

9. Attach appropriate fittings to the discharge tee to enable the discharge effluent to be directed in the required manner.

3.3.2 Pitless adaptor support assembly

1. The pitless adaptor support assembly consists of two component parts: a tee that attaches to the top of the pipe column and a discharge fitting that penetrates the side of the casing.

2. This support assembly is no longer installed; remove it in accordance with Section 3.5.2 of this appendix and replace it with a well seal support assembly.

3.4 Removing the Electric Submersible Pump

3.4.1 Removing well seal pump installations

1. Set up and operate rig in accordance with manufacturer's operating manual.

2. Detach electric plug from submersible pump wire.

3. Loosen well seal bolts to allow well seal to be lifted free from the top of the casing.

4. Attach lifting plug from mainline of rig to the tee fitting of the well seal.

    a. Lift the well seal off the casing and detach submersible wire that has been secured to the pipe column with tape or by some other method.

    b. Lower the pump assembly back down until the coupling of the first pipe section is suspended just above the top of the well casing.

5. Slide a landing plate under the first pipe coupling and lower the pump until all weight is supported by the landing plate and pipe coupling.

6. Remove the tee fitting from the discharge pipe assembly.

    a. Slide the well seal up and off the pipe nipple.

    b. Remove all fittings threaded into the first pipe coupling.

7. Attach an appropriate lifting plug to the pipe coupling resting on the landing plate.

    a. Lift the pipe section out of the well until the next pipe coupling is suspended just above the well head.

    b. Slide the landing plate under the pipe coupling and lower the discharge pipe assembly until all weight is supported by the landing plate.

8. Using the two pipe wrenches, unthread the upper pipe section from the lower pipe section (hold the lower section coupling stationary while unthreading from the top).

a. Lower and place the suspended pipe section onto a clean lay-down area.

9. Repeat steps 7 and 8 until the pump is retrieved from the well.

3.4.2 Removing pitless adaptor pump installations

1. Set up and operate rig in accordance with manufacturer's operating manual.

2. Attach lifting plug to the top of the pitless adaptor assembly threaded into the top of the discharge pipe.

3. Lift the pump assembly up until the first pipe coupling is suspended above the well head.

4. Slide a landing plate under the pipe coupling and lower the pump assembly until the weight of the assembly is supported by the landing plate.

5. Remove the tee component from the top of the discharge pipe column.

6. Repeat steps 7 and 8 in Section 3.5.1 of this appendix.

APPENDIX B

INSTALLING/REMOVING HYDROSTAR PUMP

1.0 PURPOSE

This appendix provides instructions for the installation, removal, or repositioning of Hydrostar pumps in groundwater resource protection wells.

2.0 REQUIREMENTS

1. This appendix presumes availability of a suitable rig (derrick, winch and support equipment) for hoisting the pump system (pump and discharge pipe). A rig refers to a pump setting rig, drilling rig, or functionally similar equipment/systems.
2. All hoisting (raising/lowering) of the pump and discharge assembly shall be done using the rig.
3. No grease or other foreign matter shall be allowed to contact the pump system components.
4. Normally expendable pump components shall be replaced in accordance with the manufacturer's instructions.
5. The rig shall be set up and operated in accordance with the manufacturer's operating manual.

3.0 PROCEDURE

3.1 Preparing Hydrostar Pump

1. Before installing pump system components, ensure that all components have been protected from potential contamination (e.g., sealed in plastic, kept in a protected environment).
   a. If components have not been protected from possible contamination, clean each item before installing it in the well, in accordance with Section 5.3 of this EII.
   b. Protect cleaned components from contamination until they are installed in the well, in accordance with Section 5.3 of this EII.
      - Use pipe stands, pallets, and/or plastic sheeting.

- Only lay out enough lengths of pipe to place the pump at the required depth. Measure all pipe before installation; record on the Field Activity Report -Tubular Goods Tally form (BC-6000-280).

2. If the pump is to be inspected before it is installed, perform the following:

   a. Remove the set screws located in the bottom section of the pump.

   b. Slide the internal parts of the pump out through the bottom of the pump body.

   c. Inspect the Teflon cups, O-rings, and check-valves for any irregularities; replace any damaged components in accordance with Section 3.6 of this appendix.

   d. Reinsert the Hydrostar pump components and tighten set screws.

   e. Visually inspect the pump to ensure that all nuts are secured and that the pump body is not deformed.

3. Ensure that a Hydrostar pump actuator rod is inside each section of pipe to be installed into the well.

   a. The end having the coupling and locking nut should be inserted in the same orientation for each section; the other end has a single locking nut.

4. Wrap both ends of the stainless steel discharge pipe with Teflon tape. No Teflon tape is required if PVC or ABS pipe is used.

5. Thread appropriate coupling nut onto one end of each stainless steel pipe section. Using two pipe wrenches, finish tightening the coupling until snug. For PVC or ABS pipe, glue the appropriate male/female couplings to the ends of the pipe sections and allow for setup time in accordance with manufacturer's recommendations before installing it in the well.

6. Attach Hydrostar pump screen to bottom of pump.

3.2 Installing Pump

1. Using a rig and a proper below-the-hook lifting device (e.g., lifting plug), suspend the first section of discharge pipe from the hoisting line, tailing in the pipe to prevent contact with ground or damage to pipe threads. Cover the lower end of the pipe section to prevent the inside rod from sliding out the bottom.

2. Center the pump below the suspended pipe section. Thread the rod from the pipe section into the coupling of the rod extending from the pump. Thread the rod halfway into the coupling by hand, allowing the ends of each rod to butt up against each other.

3. Hold the coupling nut with a wrench and screw the locking nut from the upper rod downward until it is flush with the top of the coupling nut. Finish tightening with a wrench. Ensure that the lower locking nut is also tight.

4. Lower the pipe section until it is approximately one foot above the Hydrostar pump. Lift the pump and thread it onto the pipe section. Do not cross thread the pump; ensure that it is lined up straight with the suspended pipe section.

5. Lift the pump and pipe section over the well and lower the assembly until the first coupling is suspended just above the well head.

6. Slide a landing plate onto the well head under the coupling and lower the pump assembly until its weight is supported by the landing plate.

7. Unthread the lifting plug from the pipe section and thread it into the next section of discharge pipe to be attached. Ensure that the lifting device is threaded onto the end that has the coupling nut on the Hydrostar pump rod.

8. Lift the discharge pipe section, tailing it in, until it centers over the section of pipe supported by the landing plate. Cover the end of the pipe so that the Hydrostar pump rod does not slide out the bottom of the pipe section.

9. Thread the Hydrostar pump rod from the suspended pipe section into the coupling of the lower rod. Thread the rod halfway into the coupling to allow the ends of each rod to butt up against each other.

10. Holding the coupling nut with a wrench, screw the locking nut from the upper rod downward until it is flush with the top of the coupling nut, then tighten with a wrench. Ensure that the lower locking nut is also tight.

11. Gently lower the suspended pipe section into the coupling of the supported pipe section. Hand thread the pipe sections together, preventing cross threading. Finish threading the sections together using two pipe wrenches until snug.

12. Repeat steps 7 through 11, above, for all pipe sections except the final section to be installed.

3.3 Installing Well Head Assembly

1. Attach the Hydrostar pump well head support plate to the final section of discharge pipe.

2. Repeat steps 7 through 11 in Section 3.3 of this appendix.

3. Gently lower the pump assembly into the well until the well head assembly comes to rest on top of the casing.

4. Remove the lifting plug from the well head assembly.

5. Slide the rod seal over the rod, and thread into the well head assembly tee.

6. Slide the tamper bolt over the rod, and thread into the rod seal.

7. The rod should extend approximately 4 inches above the top of the discharge tee assembly. If necessary, cut the rod to the proper length, and cut new threads in the rod using the proper die. The thread shall not extend below the top of the tamper bolt.

8. Thread a locking nut onto the rod, then thread a turnbuckle onto the rod.

9. Position the turnbuckle in the desired position and tighten (to snug) the locking nut against the bottom of the turnbuckle, locking both into place.

10. Adjust the eye bolt threaded into the top of the turnbuckle to the desired position, and lock the eye bolt into place using a turnbuckle locking pin.

11. Complete the appropriate portions of Figure B-1, Sample Pump Installation form, to document new well pump installation.

3.4 Removing Pump From Well

1. Set up and operate the rig in accordance with manufacturer's operating manual.

2. Detach the turnbuckle mechanism from the well head assembly rod.

3. Remove the tamper bolt and rod seal from the well head assembly tee.

4. Thread a lifting plug (attached to the mainline rig winch) into the top of the well head assembly tee and lift the section of pipe out of the well until the next pipe coupling is suspended just above the well head.

5. Slide the proper size landing plat under the pipe coupling and lower the pump assembly until the weight of the system is supported by the landing plate.

6. Separate the pipe sections using two pipe wrenches.

7. Lift the upper pipe section until the rod coupling is exposed.

8. Place a wrench on the rod coupling and using a second wrench, loosen the upper jam nut.

9. Unthread the upper rod from the rod coupling.

10. Lower and place the suspended pipe section onto a clean laydown area.

11. Thread the lifting plug device into the top of the next pipe section being supported by the landing plate.

12. Lift the pump assembly, releasing all weight from the landing plate, and remove the landing plate from the top of the well casing.

13. Lift the pipe section until the next pipe coupling is suspended just above the well head.

14. Slide the landing plate onto the well head under the pipe coupling and lower the pump system onto the landing plate.

15. Separate the pipe sections using two pipe wrenches.

16. Lift the upper pipe section until the rod coupling is exposed.

17. Place a wrench on the rod coupling and using a second wrench, loosen the upper jam nut.

18. Unthread the upper rod from the rod coupling.

19. Lower and place the suspended pipe section onto a clean laydown area.

20. Repeat steps 10 through 18 until all pipe sections and pump have been removed from the well.

3.5 Removing, Inspecting, and Repairing Pumps

1. If a Hydrostar pump is not operating properly, examine the pump.

2. Remove the hexhead set screws located at the base of the pump.

3. Slide the lower check valve from the base of the pump.

4. Slide the internal components through the base of the pump.

5. Visually inspect the pump components (e.g., O-rings, Teflon cups) for damage.

6. If a component is damaged, remove it from the pump, noting how it is removed and its orientation in the pump with respect to other pump components.

7. Replace the component with a replacement component provided (or approved) by the manufacturer of the Hydrostar pump. Replace the component in accordance with the manufacturer's specific manual instructions.

8. Reassemble the pump in the reverse order of disassembly. Test the pump at a pump test work station to ensure it is functioning according to the manufacturer's specification.

3.6 Testing Pumps

1. Testing of a new Hydrostar pump is only required after it has been installed in a newly constructed well, but this procedure may also be used when testing Hydrostar pumps installed in existing wells.

2. Attach discharge hose to 3/4-inch adapter.

3. Discharge water into purge truck until flow rate stabilizes (total should not exceed 5 gallons).

4. Stop pumping by valving out air supply to pump air motor.

5. Direct hose into a 5-gallon container, then slowly open air supply valve. Open valve slowly to minimize splashing.

6. Begin counting pump cycles at first complete stroke. A full cycle is from bottom of stroke to top of stroke and back to bottom or the reverse.

NOTE: The speed of pumping is not a concern.

7. A 100% efficient Hydrostar will pump approximately 0.1 gallons per stroke.

8. Calculate pump efficiency and record results on Figure B-1 in the Pump Testing Information block.

9. Required response:

   efficiency = >80% no response required
   = 70-80% inform cognizant engineer/Field Team Leader
   = pull pump, rebuild or replace, recheck.

10. The Sample Pump Installation form, Figure B-1, is nonrecord field information. Process as follows:

    a. Submit the completed form to the file custodian.

    b. File custodian forwards a copy of the form to the well maintenance organization.

    c. File the completed form in the project file.

1.0 PURPOSE

This Environmental Investigations Instruction (EII) specifies evaluation criteria and documentation requirements for the characterization and evaluation process of determining fitness-for-use recommendations to meet applicable data quality objectives (DQO) of existing resource protection wells.

2.0 SCOPE

This EII applies to well characterization and fitness-for-use evaluation for existing resource and nonresource protection wells on the Hanford Site at the direction of the cognizant manager.

3.0 DEFINITIONS

See the Glossary/Acronyms section of this manual.

4.0 RESPONSIBILITIES

The cognizant manager assigns a qualified cognizant engineer to implement this EII.

5.0 REQUIREMENTS

Fitness-for-use characterization and evaluation for existing resource protection wells identified for use is required by the Hanford Well Remediation and Decommissioning Plan (WHC-SD-EN-AP-122).

Wells are identified for use by Hanford Site user groups who provide DQOs for use in fitness-for-use characterization and evaluation.

6.0 PROCEDURE

6.1 Characterization

Cognizant Engineer

1. Review existing well construction data and complete the Fitness-For-Use Checklist (A-6000-451, Siteform 0687, form completion instructions are also located on Siteforms).

   a. The checklist has been developed from the construction standards for new groundwater well construction contained in WAC 173-160, WAC 173-303, and OSWER Directive 9950.

   b. Use additional applicable guidance and specific case waivers contained in correspondence received from the Washington State Department of Ecology (Ecology).

   c. Identify sources used. Existing well construction data are filed by well number at the *Well Services* Record Center and with the Pacific Northwest

Laboratory (PNL) Geosciences Department. The amount and quality of well data varies greatly because of various construction dates and documentation methods. Well data typically may include the following types of information:

1) Driller's and geologic logs

2) Publications (e.g., PNL 6907, *Hanford Wells*, and drilling histories)

3) Geophysical logs

4) Chemical/radionuclide water sample analyses

5) Groundwater well sampling and measurement schedules and data

6) Well maintenance and remediation records

7) Computer database files.

Cognizant Engineer

d. Use the following means to collect information concerning the present physical condition of the well structure.

1) **Field checks.** A field check of each well site addresses surface protection, capping and identification. Perform field checks in accordance with EII 6.4 and document using a checklist and a photograph of the wellhead.

2) **Borehole logging (optional).** Television camera scans (EII 6.4) and existing geophysical logs (primarily neutron, natural gamma and caliper) provide borehole information (e.g., casing and screen condition).

6.2 Well Construction and Completion Summary

Cognizant Engineer

1. Complete or direct completion of a Well Construction and Completion Summary, using all available data from sources documented on the Fitness-For-Use Checklist.

   a. Complete summaries based on a common format revised to fit the specific construction details of the well under evaluation. An example is shown in Figure 1.

   b. The drawings should contain the minimum information shown (when applicable) or a "not documented" (ND) notation.

c. The scale may be diagrammatic. Give measurements in decimal feet or inches to the precision used in the source, i.e., do not show an entry of 8 inches as 8.00 inches.

d. Show extrapolations made from undocumented assumptions as (Nom) for nominal, for example, 9-in. hole size (Nom) based on the use of 8-in. casing with a shoe.

e. Date and attach the summary drawings to the Fitness-For-Use Checklist.

6.3 Evaluation of Resource Protection Wells

Cognizant Engineer

1. Complete the Fitness-For-Use Checklist status recommendation using the decision tree process shown in Figure 2 by entering YES, NO or ND in the bracketed spaces.

    a. Not applicable (NA) may be used where the checklist item does not apply (i.e., the well is not a monitoring well and does not have a screen).

    b. Provide references used and supporting details for positive recommendations made for each specific category. Provide comments when applicable.

6.4 Review and Approval

Cognizant Engineer

1. Generate a diagrammatic remediation or decommissioning plan (Figure 3) when remediation or decommissioning is recommended on a supporting document in accordance with WHC-CM-6-1, EP-1.12.

2. Provide the status recommendation and the remediation or decommissioning plan to all users and concerned organizations (reviewers) identified during the characterization process.

    a. Reviewers may request reevaluation based on additional information or potential uses they provide.

    b. Review and disposition is in accordance with WHC-CM-6-1, EP-1.6. The supporting document will consist of the Fitness-For-Use Checklist, Well Construction and Completion Summary and Diagrammatic Remediation or Decommissioning Plan (if required) for one well or groups of related wells.

6.5 Records

Record processing and disposition is as follows.

Name, Filing Unit Title or Description	Record Type*	Retention Period	Disposal Authority	Cut-off and Retirement Instructions
Fitness-for-Use checklist and supporting documentation	QA	TBD	TBD	When no further action is required to the well, transmit checklist and supporting documentation to file custodian (FC) for submittal to permanent storage per RIDS. FC places reference copy in project files maintained by well number and cross references to operable unit or operating facility in database. Copies are transmitted to users as necessary.

* QA = Quality Assurance; TBD = To be determined

7.0 FORM

Fitness-For-Use Checklist and Completion Instructions (A-6000-451, Siteforms).

8.0 DESIGNATED REVIEWING ORGANIZATION

The organization designated to review changes to this document is listed below.

Designated Reviewers	CMPOC
Hanford Technical Services, process owner	*STS/HTS*

Comments from other organizations are welcome; however, such comments are dispositioned at the option of the originating organization.

9.0 REFERENCES

OSWER 9950, "RCRA Ground Water Monitoring Technical Enforcement Guidance Document."

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells."

WAC 173-303-645, "Ground Water Protection."

PNL-6907, *Hanford Wells.*

WHC-CM-6-1, *Standard Engineering Practices.*
EP-1.6, "Engineering Data Transmittal Requirements."
EP-1.12, "Supporting Document Requirements."

WHC-SD-EN-AP-122, *Hanford Well Remediation and Decommissioning Plan.*

Figure 1. Example Well Construction and Completion Summary.
(sheet 1 of 2)

WELL CONSTRUCTION AND COMPLETION SUMMARY

Drilling Method: Cable tool
Drilling Fluid Used: 200 E Water Supply
Driller's Name: Wamsley
Drilling Company: Kaiser Engineers
Date Started: 04Dec89

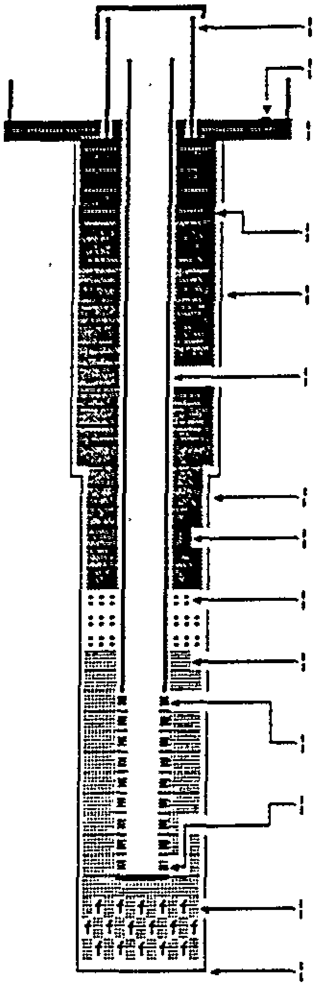
Sample Method: Drive barrel Hard tool
Additives Used: Not documented
WA State Lic Nr: Not documented
Company Location: Hanford
Date Complete: 17Apr90

WELL NUMBER: 299-E27-16
TEMPORARY WELL NO: ________
Hanford Coordinates: N/S N 44,897 E/W W 51,544
State NAD83 Coordinates: N 137,165.12m E 574,179.47m
N 450,066 E 2,243,666
Start Card #: Not documented T__ R__ S__
Elevation Ground surface (ft): 649.19 (Brass cap)

Depth to water: 244.5-ft Dec89
(Ground surface) 247.1-ft Dec92

GENERALIZED STRATIGRAPHY
Geologist's Log

0-5: Muddy sandy GRAVEL
5-10: Sandy GRAVEL
10-15: SAND
15-30: Sandy GRAVEL
30-35: Sl. gravelly SAND
35-95: SAND
95-100: Sl. gravelly SAND
100-110: SAND
110-115: Sl. gravelly SAND
115-120: Gravelly SAND
120-125: Sl. gravelly SAND
125-130: SAND
130-155: Sl. gravelly SAND
155-170: SAND
170-175: Sl. gravelly SAND
175-180: Gravelly SAND
180-185: Sl. gravelly SAND
185-195: Gravelly SAND
195-202: SAND
202-205: Sl. gravelly SAND
205-210: Sandy GRAVEL
210-215: SAND
215-220: Gravelly SAND
220-240: Sandy GRAVEL
240-245: Muddy sandy GRAVEL
245-250: Sandy GRAVEL
250-260: SAND
260-269: Muddy sandy GRAVEL
269 : BASALT



Elevation of reference point: [652.13-ft]
(top of 6-in casing)
Height of reference point above ground surface [2.9-ft]
Depth of surface seal [2-20.3-ft]
Type of surface seal: Portland cement
4-ft x 4-ft x 6-in surface pad.
4 equidistant protective posts.
Cement grout to 20.3-ft
11-in nominal hole diameter, 2-145-ft
I.D. of riser pipe: [4-in]
Type of riser pipe:
Stainless steel
9-in nominal hole diameter, 145.0-269.0-ft
Type of filler:
Bentonite crumbles
Depth top of seal: [231.2-ft]
Type of seal:
1/4-in Volclay pellets
Depth top of sand pack: [234.8-ft]
20-40 mesh silica sand
Depth top of screen: [238.7-ft]
4-in stainless steel, #10-slot
Channel pack
Depth bottom of screen: [259.7-ft]
Backfill, 263.7-269.0-ft
Depth bottom of borehole [269.0-ft]

Drawing By: RKL/2E27-16.ASB Date: 30Dec92
Reference: WHC-MR-0207, Oct90

Figure 1. Example Well Construction and Completion Summary.
(sheet 2 of 2)

SUMMARY OF CONSTRUCTION DATA AND FIELD OBSERVATIONS
RESOURCE PROTECTION WELL - 299-E27-16

WELL DESIGNATION : 2-E27-16
RCRA FACILITY : 216-B-63 Trench
CERCLA UNIT : 200 Aggregate Area Management Study
HANFORD COORDINATES : N 44,897 W 51,544 [19Apr90-200E]
LAMBERT COORDINATES : N 450,066 E 2,243,666 [HANCONV]
N 137,165.12m E 574,179.47m [19Apr90-NAD83
DATE DRILLED : Apr90
DEPTH DRILLED (GS) : 269.0-ft
MEASURED DEPTH (GS) : Not documented
DEPTH TO WATER (GS) : 244.5-ft, Dec89;
247.4-ft, 09Mar93
CASING DIAMETER : 4-in, stainless steel, +1.8↔238.7-ft;
6-in, stainless steel, +2.9↔~0.5-ft
ELEV TOP CASING : 652.13-ft [19Apr90-200E]
ELEV GROUND SURFACE : 649.19-ft, Brass cap [19Apr90-200E]
PERFORATED INTERVAL : Not applicable
SCREENED INTERVAL : 4-in stainless steel with channel pack, 238.7↔259.7-ft
COMMENTS : FIELD INSPECTION,
OTHER;
AVAILABLE LOGS : Geologist, Driller
TV SCAN COMMENTS : Not applicable
DATE EVALUATED : Not applicable
EVAL RECOMMENDATION : Not applicable
LISTED USE : B-63 Trench Quarterly water level measurement, 20Nov90↔09Mar93;
Not on water sample schedule
PUMP TYPE : Hydrostar
MAINTENANCE :

Figure 2. Decision Tree for Determining Fitness-For-Use.

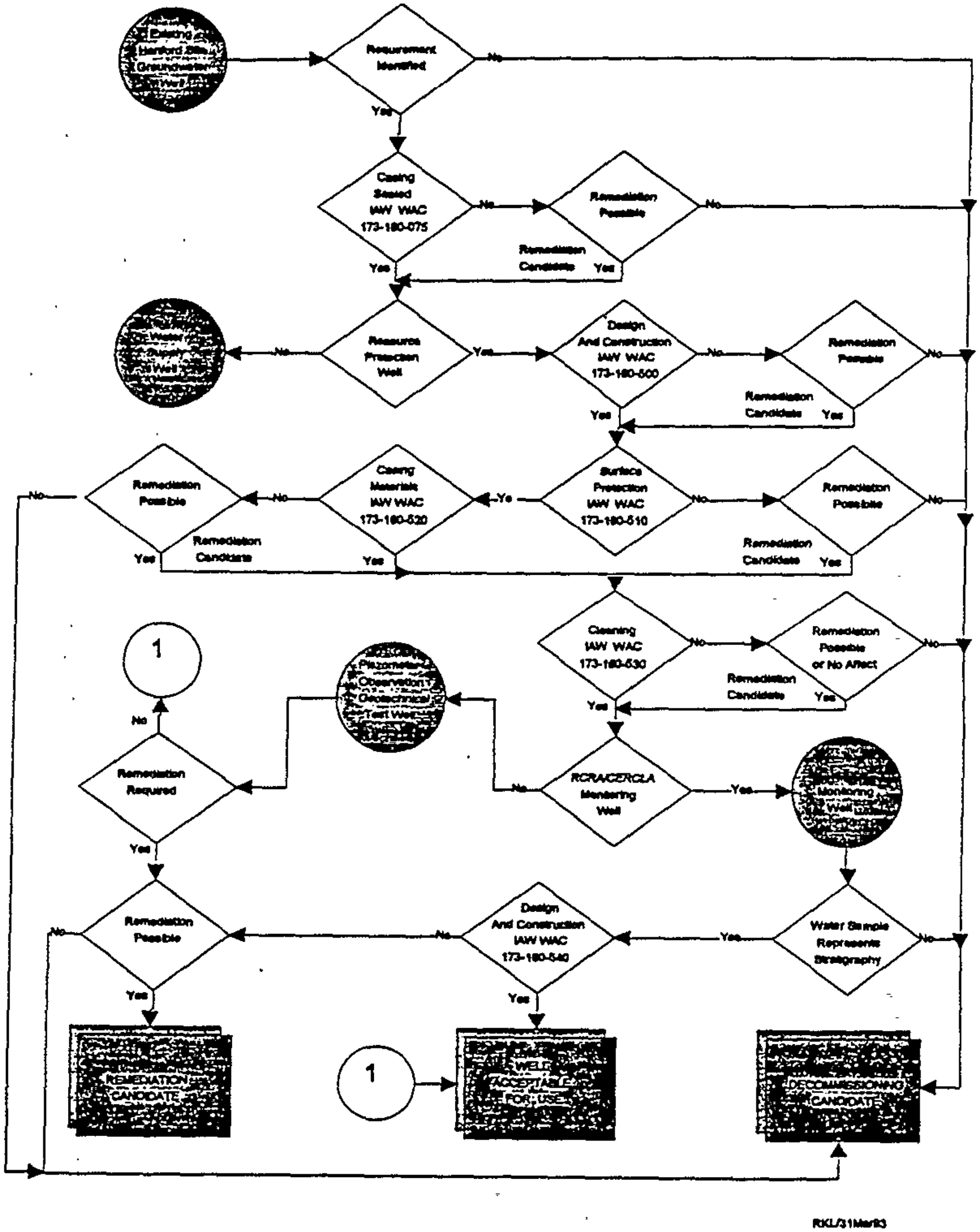


Figure 3. Example Diagrammatic Remediation Plan.

DIAGRAMMATIC REMEDIATION PLAN

Drilling Method: Cable tool
Drilling Fluid Used: Water
Driller's Name: Ford, Row, Jack
Drilling Company: Not documented
Date Started: Original 14Mar51, Deepened 21Apr54

Sample Method: Hard tool (nom)
Additives Used: Not documented
WA State Lic Nr: Not documented
Company Location: Not documented
Date Complete: Original 10Apr51, Deepened 12Jul54

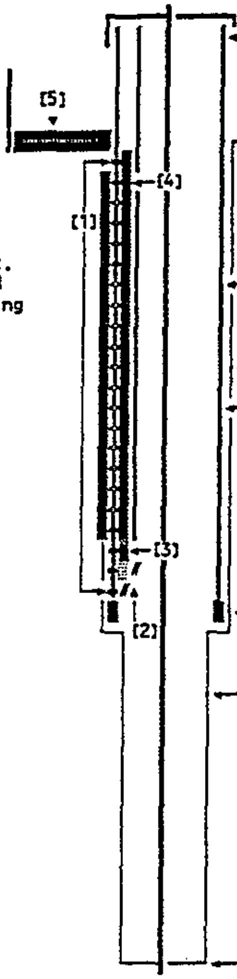
WELL NUMBER: 399-5-2 TEMPORARY WELL NO: 303-13
Hanford Coordinates: N/S S 26,416 E/W E 9,325
State Coordinates: N Not documented E Not documented
RN 52,961.3 RE 10,931.4
Start Card #: Not documented T____ R____ S______
Elevation Ground surface (ft): 389.1 Estimated

Depth to water: 9.0-ft Jul54
(Ground surface) 6.0-ft Jul75

REMEDIATION ACTIVITIES

1. Perforate casing from 1-ft below ground surface to 194-ft.
2. Install 4-in liner to 195-ft. Liner to have flared bottom and to be anchored to top of existing casing.
3. Install short lifts of sand and bentonite to seal annulus.
4. Pressure grout annulus to 1-ft below ground surface.
5. Install concrete pad with brass survey marker and 4 protective posts. Extend casing to 30-in stickup.
6. Paint casing, posts and identification number on post. Stamp identification number on brass marker.
7. Survey to water level measurement standards.

NOTE:
Field conditions may require adjustment of work sequence and completion depths.



Elevation of reference point: (top of casing) [390.71-ft]
Height of reference point above ground surface [1.6-ft]
Depth of surface seal [ND]
Type of surface seal: None documented
I.D. of surface casing (If present) [ND]
I.D. of riser pipe: [8-in]
Type of riser pipe: Carbon steel
Diameter of borehole: [9-in nom]
Type of filler: Not documented
Depth top of perforations: [ND]
Description of perforations: None documented
Depth bottom of casing: [195-ft]
Diameter of borehole: [8-in nom]
Depth bottom of borehole: [424-ft]

Drawing By: RKL/3-05-02.PLN Date: 16Jun93
Reference: HANFORD WELLS

INSTRUCTION CHANGE AUTHORIZATION

ICA No. ICA 089

Instruction (EII) No.	Rev. No.	
EII 5.4, Field Cleaning and/or Decontamination of Equipment EII 6.7, Documentation of Well Drilling and Completion Operations	5 3	Page 1 of 2

Description of Change

Impact Level ~~3~~ 2Q MT 2/10/94

Documentation for the In Well Stripping and In Situ Bioremediation Wells, 299-W15-25, 299-W15-26, 299-W15-27, 299-W11-33, 299-W11-34, 299-W11-35, and 299-W11-36 will be generated by the following EII forms:

- Sonic Rig FAR and Continuation page - EII 6.7
- Well Construction Summary Report - EII 6.7
- Tubular Goods Tally FAR (continuation sheet) - EII 6.7
- Field Cleaning and/or Decontamination - EII 5.4

Each days documentation will be printed for review/approval by the appropriate individuals. The completed documents will be submitted to the WHC Field Team Leader for disposition in accordance with the record requirements of the EIIs referenced above for the comparable EII form. The information fields of the laptop computer system have been verified against the comparable EII form by the Field Team Leader.

APPLICABLE ONLY AT THE IN WELL STRIPPING AND BIOREMEDIATION WELLS - 299-W15-25, 299-W15-26, 299-W15-27, 299-W11-33, 299-W11-34, 299-W11-35, and 299-W11-36.

[X] One Time [] Permanent

Justification

Streamlines field generation of documentation and required information is captured. No impact on quality is anticipated.

Approvals: (Type/Sign Name and Date)

L. O. Amos	2/7/94	D. J. Moak	2-7-94
ICA Author	Date	ICA Author's Manager	Date
D. J. Moak	2-7-94	W. R. Thackaberry	2-8-94
EII Author's Manager	Date	Quality Assurance (If Required)	Date
		n/a	
		Safety (If Required)	Date

A-6000-370 (12/91) (EF) WEF158

TITLE:

DOCUMENTATION OF WELL DRILLING AND COMPLETION OPERATIONS

Approved by

W. H. Price, Manager
Environmental Field Services

1.0 PURPOSE

The purpose of this Environmental Investigations Instruction (EII) is to provide instructions for documenting the drilling and construction of resource protection wells and geotechnical boreholes (vadose wells) in accordance with the design specifications and/or subcontract documents.

2.0 SCOPE

This procedure applies to documentation of activities conducted at resource protection well and geotechnical borehole (vadose zone) sites. It also applies to activities required prior to the start of drilling and after drilling has been completed.

3.0 DEFINITIONS

Refer to the Glossary/Acronyms section of this manual.

4.0 RESPONSIBILITIES

4.1 Field Team Coordinator or Field Team Leader

The Field Team Coordinator (FTC) or Field Team Leader (FTL) is responsible for appropriate implementation and required documentation of the activities specified by the Groundwater Monitoring Plan (RCRA), Work Plan (CERCLA), or Description of Work (DOW), applicable well specification (WHC-S-014, WHC-S-0105), and EIIs.

4.2 Well Site Geologist

The well site geologist is responsible for completing required documentation as specified with the exception of the Drilling Planning and Well Completion forms.

*This is a total rewrite; therefore, no revision bars are used to indicate changes.

5.0 REQUIREMENTS

5.1 Start Card

1. The Notice of Intent to begin well construction, "start card," must be filed with the Washington State Department of Ecology (Ecology) in accordance with WAC 173-160-055, "Well Construction Notification (start card)." *Start cards are to be filed with the Kennewick Office of Ecology at least 72 hours before commencement of work.*

2. *Start cards are required for all groundwater wells, resource protection wells, cased geotechnical test borings, and uncased geotechnical test borings. Test pits do not require a start card.*

3. *DOE/RL has delegated the necessary authority to WHC to ensure timely and proper submittal of start cards before groundwater well drilling at the Hanford Site.*

4. *Start card information shall be provided to WHC at least five working days before the initiation of any well drilling. Information must include well location (township, range, section and 1/4 section), proposed use, approximate start and completion dates, contractor's registration number (if applicable), driller's name and license number (if known) and drilling company's name.*

5. *A fee of $40 dollars for each resource protection or monitoring well construction start card has been imposed by Ecology. WHC will be responsible for tabulation and forwarding of required fees. Fees are assessed on a case be case basis if necessary.*

6. *The Subsurface Investigations Support Function (SIS) of WHC will coordinate start card submittals for all RCRA and CERCLA wells drilled at Hanford.*

5.1.2 Well Identifier Number

1. *SIS is responsible for issuing a unique well identifier number for each well or test boring requiring a start card. The numbers are tracked in the Hanford Wells Database System maintained by SIS. Numbers assigned to a well will not be duplicated or changed.*

5.2 Waste Management

Waste shall be labeled and managed in accordance with the requirements of EII 4.2 as applicable.

5.3 Documentation Completion

1. Make entries on documents using permanent, reproducible black ink whenever possible.

2. Make corrections or deletions by striking a single line through the error and writing initials and the date. Enter correct information as near the correction as possible.

3. Where blocks do not apply, enter N/A (not applicable). Where entire sections of the form(s) do not apply, line out the sections and enter N/A.

4. Transmit Field Activity Reports (FAR) for the current shift to the FTL/FTC for review by the end of the following shift.

5.4 Resource Protection Well Documentation

Resource Protection Well Documentation Guideline, Figure 1, illustrates WHC-CM-7-7 documentation associated with a typical groundwater monitoring well. Documentation requirements described below are specific to EII 6.7; forms and completion instructions can be found as jetforms.

5.4.1 Preliminary

The Project Engineer (PE) or FTL completes the Drilling Planning form verifying that all documents and actions prerequisite to the start of drilling operations have been completed.

5.4.2 Drilling/sampling to design (total) depth

The well site geologist generally completes the appropriate drilling-related FAR to maintain a chronological log of drilling operations. FAR names and form numbers are listed in Section 8.0 of this EII. Complete the FAR specific to the drilling method being used to advance the well in adequate chronologic detail to generally reconstruct site activities.

Use the Tubular Goods Tally to maintain an up-to-date record of stainless steel casing in the well during completion; use is optional for recording temporary casing during drilling to total depth. Use a FAR continuation page(s), Drawing Continuation Page and/or Cement Calculations Continuation Page as needed for completeness.

5.4.3 Well construction

The well site geologist documents the following:

1. Construction details on the Well Construction Summary Report.

2. WHC-S-014 specification requirements on the Well Construction Verification Report.

3. Cementing operations, when determined necessary by the FTL/FTC, by entering estimated volumes of material necessary on the Cement Calculations Continuation Page.

4. Material added, temporary casing removed, and downhole depths measured during well construction on the Well Completion Log.

5. Daily drilling operations to maintain a chronological log on the appropriate drilling-related FAR.

5.4.4 Well completion

The FTL or Cognizant Engineer (RCRA) finalizes/approves the Well Completion form as a final checklist that the documents associated with a particular well have been completed.

5.5 Geotechnical Boreholes (Vadose Wells)

Geotechnical Borehole (Vadose Well) Documentation Guideline, Figure 2, illustrates WHC-CM-7-7 documentation associated with a typical vadose well. Documentation requirements described below are specific to EII 6.7; forms and completion instructions can be found as jetforms.

5.5.1 Preliminary

The FTL completes Drilling Planning verifying that all documents and actions prerequisite to the start of drilling operations have been completed.

5.5.2 Drilling/sampling to design (total) depth

The well site geologist completes the appropriate drilling-related FAR to maintain a chronological log of drilling operations. FAR names and numbers are listed in Section 6.0 of this EII. Complete the FAR specific to the drilling method being used to advance the well in adequate chronologic detail to reconstruct site activities.

The FAR Tubular Goods Tally may be used to maintain an up-to-date record of temporary casing in the well. Use a FAR continuation page(s), Drawing Continuation Page and/or Cement Calculations Continuation Page as needed for completeness.

5.5.3 Abandonment

The well site geologist uses the FAR appropriate to the drilling method used to advance the well to document withdrawal of temporary casing and abandonment operations. The location is permanently marked in accordance with WAC 173-160 and WHC-S-0105.

5.6 Sample Traceability

Unique sample numbers will be assigned to each chemical and physical property sample taken in support of environmental monitoring and restoration activities. Sample data stored in the Hanford Environmental

Information System (HEIS) require a unique sample number registered in the HEIS Sample Number Library (HSNL).

Chemical samples shall use HEIS sample numbers; physical samples may use HEIS sample numbers or customer sample numbers that conform to the site standard of up to 16 alpha-numeric characters. Archive samples require registration of a unique sample number in the HSNL only upon removal from the Hanford Geotechnical Library in accordance with EII 5.7A. When HEIS sample numbers are used, the requirements of EII 5.10, section 4.1 apply.

6.0 RECORDS

Processing and disposition of records generated during implementation of this EII are specified by Table 1.

7.0 DESIGNATED REVIEWING ORGANIZATIONS

Organizations designated to review changes to this document are listed below. The controlled manual point-of-contact (CMPOC) listed for the designated reviewing organization(s) is responsible for coordinating the review and consolidating and submitting comments to the originating organizations.

Designated Reviewing Organizations	CMPOC
Kaiser Engineers Hanford	CS/CFD
Environmental Projects	EA

Comments from other organizations are welcome; however, such courtesy comments are resolved at the option of the originating organization.

8.0 FORMS

The following forms and instructions are available on jetform.

Drilling Planning (A-6000-422)

FAR - Cable Tool Rig (BC-6000-290) and Continuation Page (BC-6000-397)

FAR - Auger Rig (BC-6000-277) and Continuation Page (BC-6000-396)

FAR - Core Rig (BC-6000-288)

FAR - Sonic Rig (BC-6000-788) and Continuation Page (BC-6000-787)

FAR - Air Rotary Rig (BC-6000-779) and Continuation Page (BC-6000-780)

FAR - Tubular Goods Tally - Continuation Page (BC-6000-280)

FAR - Drawing Continuation Page (BC-6000-281)

FAR - Cement Calculations - Continuation Page (BC-6000-279)

Well Completion (A-6000-435)

Well Completion Log (A-6000-437)

Well Construction Summary Report (A-6000-436)

Well Construction Verification Report (A-6000-868)

9.0 REFERENCES

WAC 173-160, "Minimum Standards for Construction and Maintenance of Water Wells."

WHC-S-014, "Generic Specification-Groundwater Monitoring Wells."

WHC-S-0105, "Specification for Vadose Zone Geotechnical Test Borings."

10.0 BIBLIOGRAPHY

29 CFR 1910, "Occupational Safety and Health Standards."

40 CFR 260-265, "Resource Conservation and Recovery Act Hazardous Waste Regulations."

ASTM D 422, "Standard Method for Particle-Size Analysis of Soils."

DOE Order 5480.1B, "Environment, Safety and Health Program for DOE Operations."

WAC 173-162, "Regulation and Licensing of Well Contractors and Operators."

WHC-CM-3-5, Document Control and Records Management Manual. Section 5, "Records Storage, Retrieval and Destruction."

WHC-CM-8-7, Operations Support Services, Section 503.1, "Excavation Permits."

Table 1. Record Requirements.

NAME Filing Unit Title or Description	RECORD TYPE*	RETENTION PERIOD	DISPOSAL AUTHORITY	CUT-OFF AND RETIREMENT INSTRUCTIONS
FARs: Sonic Rig (BC-6000-788), Core Rig (BC-6000-288), Auger Rig (BC-6000-277), Cable Tool Rig (BC-6000-290), Air Rotary Rig (BC-6000-779)	QA	TBD	TBD	Transmit to FC upon completion for submittal to IRM permanent storage per approved RIDS. FC places copy in project file.
Well Construction Summary Report (A-6000-436), Well Construction Verification Report (A-6000-868)	QA	TBD	TBD	Transmit to FC upon completion for submittal to IRM permanent storage per approved RIDS. FC places copy in project file.
Drilling Planning (A-6000-422), Well Completion (A-6000-435), *Well Completion Log (A-6000-437)*	R	TBD	TBD	Transmit to FC when no longer needed, for development of the project file.
Rig-specific continuation sheets and Cement Calculations (BC-6000-279), Tubular Goods Tally (BC-6000-280), Drawing Continuation Page (BC-6000-281)	QA	TBD	TBD	When used, transmit to FC upon completion for submittal to IRM permanent storage per approved RIDS. FC places copy in project file.

* QA - Quality Assurance; R - Record Material

Figure 1. Resource Protection Well Documentation Guideline.

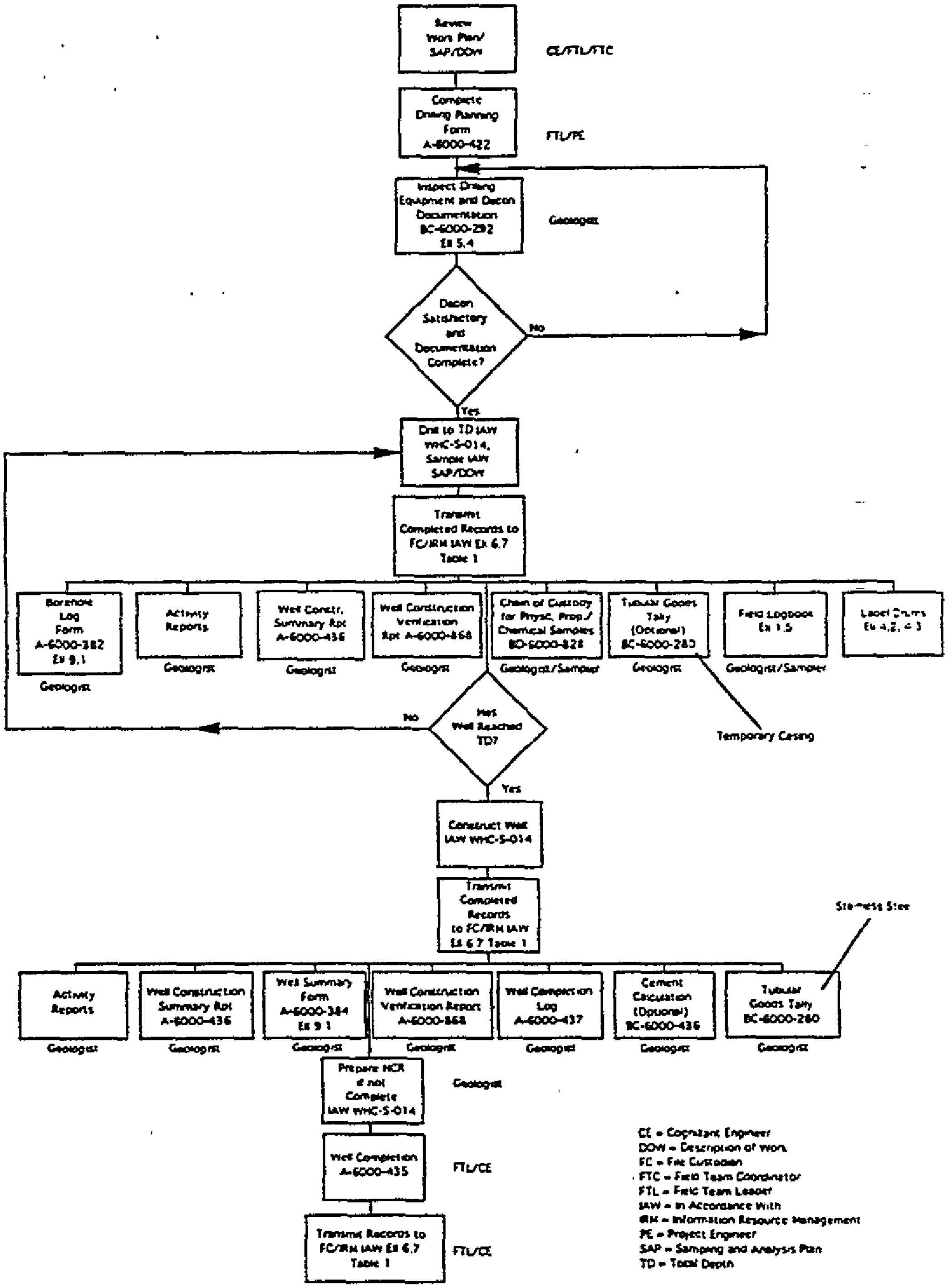
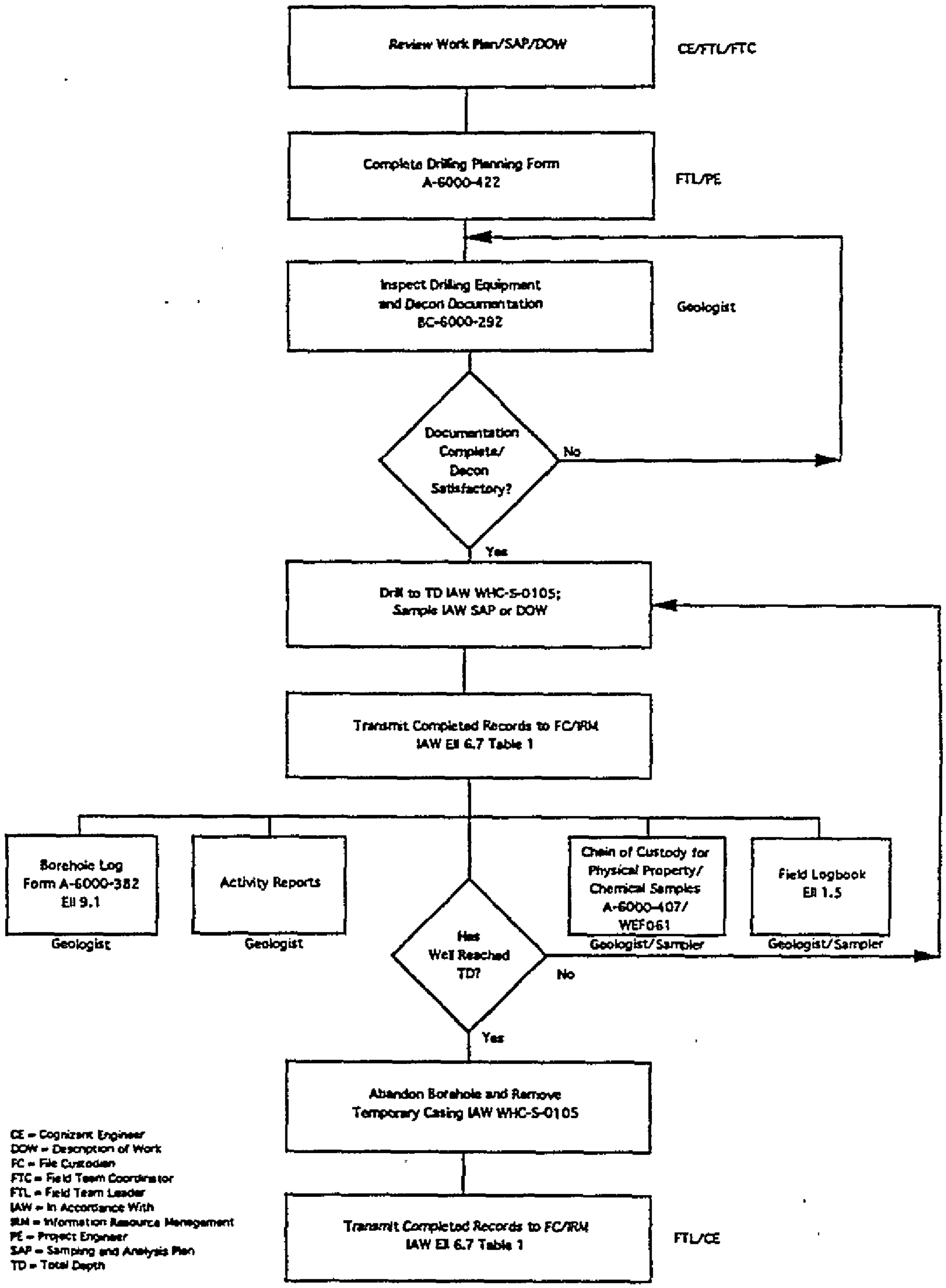


Figure 2. Geotechnical Borehole (Vadose Well) Documentation Guideline.



TITLE:

GROUNDWATER WELL AND BOREHOLE IDENTIFICATION AND TRACKING

Approved by

JW Cammann

J. W. Cammann, Manager
Environmental Services

1.0 PURPOSE

This procedure provides the method for assigning well identification numbers and the Hanford Site well names and temporary names to wells and boreholes drilled on the Hanford Site.

2.0 SCOPE

This procedure applies to groundwater resource protection wells, groundwater monitoring wells, vadose zone boreholes, and geotechnical test borings installed (drilled) under the responsibility of the Westinghouse Hanford Company (WHC). This system of assignment is established to coordinate with all prior (historical) systems of well identification, where possible. Existing wells and boreholes may be assigned well identification numbers as needed.

3.0 DEFINITIONS

See the Glossary/Acronyms section of this manual.

4.0 RESPONSIBILITIES

Contained in Section 6.0.

5.0 REQUIREMENTS

1. Well identification numbers shall be obtained for all wells and boreholes before field activities begin. Obtain numbers from the Well Identification Coordinator or a designee.

2. All in-process documents and records of construction, maintenance operations, sampling, and other documentation generated shall include the well identification number and the well name or temporary well name.

3. In this procedure, when the term "Well Identification Coordinator" (WIC) is used, it is understood to mean the WIC or designee.

5.1 Permanent Identification

1. The well identification number assigned shall be affixed to the well casing (if present) and on a brass survey pin (if present) located at each site.

2. Vadose zone wells and geotechnical boreholes shall be labeled where possible.

5.2 Well Name and Temporary Name

1. If required, a well name shall be assigned and affixed to each borehole. The well name will be affixed to the well casing (and to the protection post, if present) in one of two ways: stenciled or labeled with an adhesive label. Assignment of the well name is standard practice and can only be waived by the WIC. The WIC can help get well names assigned when necessary.

2. During the project planning phase, temporary well names may be assigned to borings. However, before actual drilling of the borings begins, at least a well identification number must be assigned.

5.3 Borehole Identification

If the borehole to be drilled requires state notification (start card), then the start card shall include the assigned well identification number.

6.0 PROCEDURE

6.1 Well Identification Number

The well identification number is a five character field and consists of the last five characters of the barcode number as currently assigned to water level wells (e.g., A1234). Each piezometer is assigned a unique number.

Requestor	1. Request a number or a block of numbers from the Well Identification Coordinator or the trained designee.
WIC	2. Review the request, verify the well name, and assign each well a unique number.
Requestor	3. Return unused numbers to the Well Identification Coordinator for reassignment.

6.2 Well Name

Well names consist of three groupings of alphabetic and/or numeric characters, separated by hyphens. The well name is used to be consistent with the existing Hanford Site well numbering system.

1. The first symbol refers to the Site Area, followed by the number 99, which identifies the structure as a well. Site Area is identified using the first numeral in the Area identifier; e.g., 199 is a well in the 100 Area; 299 is a well in the 200 Area. An example of a specific well in the 200 area is 299-W19-2. The remainder of the alpha numeric provide information on the location of the well.

6.2.1 Additional Well Designations

Wells adjacent to tank farms are given an additional unique number assigned by WHC Tank Farm Surveillance and Operations consisting of the reference tank and a clock orientation, where 12 o'clock is toward geographic north.

7.0 RECORDS

Record processing and disposition is in accordance with table 1. The following documents are to be put on a transmittal prior to submitting to the FC.

Note: Well identification numbers (WIN) assigned by the Well Identification Coordinator are written into a logbook and maintained in a database to preclude duplicate numbering and allow reissuance of unused numbers. The WIN is entered on the start card and sent to the Washington Department of Ecology.

8.0 DESIGNATED REVIEWING ORGANIZATION

Organizations designated to review changes to this document are listed below. The controlled manual point-of-contact (CMPOC) listed for the designated reviewing organization(s) is responsible for coordinating the review and consolidating and submitting comments to the originating organization.

Designated Reviewers	CMPOC
Document and Records Service	IRM/DRM
Geotechnology	RR/LWD

Comments from other organizations are welcome; however, such courtesy comments are resolved at the option of the originating organization.

9.0 FORMS

None

10.0 REFERENCES

WAC 173-160, "Minimum Standards for Construction and Maintenance of Water Wells."

PNL-8800, Hanford Wells.

Table 1. Record Requirements.

NAME Filing Unit Title or Description	RECORD TYPE*	RETENTION PERIOD	DISPOSAL AUTHORITY	CUT-OFF AND RETIREMENT INSTRUCTIONS
Field Logbooks	QA	TPA + 10 years	DRS 1.8.c (Force Fit) TBD	Submit copies to FC on a weekly basis. When no further entries are required at project completion or when no longer needed, submit logbook to FC for transmittal to IRM permanent storage. FC places copy in project file.

* QA = Quality Assurance

1.0 PURPOSE

This Environmental Investigations Instructions (EII) specifies responsibilities and work control methods for initiation, direction and documentation of decommissioning activities for wells on the Hanford Site.

To prevent the well from being used for purposes other than intended and to preclude migration of contaminants into or between aquifers, individual wells are identified for decommissioning.

Decommissioning may also be necessary to withdraw the well from use in the following instances:

- The well is not suitable for rehabilitation or has failed structurally
- The well is not chemically compatible with its environment
- The well is no longer required for any documented use.

2.0 SCOPE

This instruction applies to the decommissioning or proper abandonment of wells on the Hanford Site.

An abandoned well is a well that has been filled or plugged so it is rendered unproductive. A properly abandoned well will not produce water or serve as a channel for movement of water (WAC 173-160-030).

The term "decommissioned well" used in this EII is a well that has been properly abandoned and its abandonment has been documented according to state requirements.

3.0 DEFINITIONS

See the Glossary/Acronyms section of this manual.

4.0 REQUIREMENTS

Requirements for protection of groundwater quality are contained in WHC-CM-7-5, Section 8. Specific requirements for well installation and use are as follows:

1. Groundwater monitoring wells shall be constructed in accordance with the relevant requirements of WAC 173-160 and 173-162.

2. Groundwater monitoring wells shall be operated in accordance with WAC 173-162 and the requirements of WAC 173-160 applicable to resource protection wells.

4.1 Well Decommissioning

The general requirements of WAC 173-160 for decommissioning or proper abandonment of wells are contained in WAC 173-160-415, "Abandonment of Wells". WAC 173-160, Sections 420 through 465 provide specific requirements applicable to the type of well being abandoned.

4.1.1 Identification of wells for decommissioning

Wells are identified for decommissioning by the process described in WHC-SD-EN-AP-122. EII 6.6 provides the mechanism to establish, review and approve technical requirements for individual well decommissioning.

4.1.2 Decommissioning of identified wells

Specific technical requirements for wells identified as requiring abandoning/decommissioning on the Hanford Site shall comply with the standards of WAC 173-160 (and applicable Ecology guidance and waivers) to provide for protection of public health, the environment and aquifer water quality.

Technical requirements will be detailed in the applicable approved EII 6.6 fitness-for-use evaluation package.

4.2 Ecology Variances

The following guidance and Hanford Site-specific variances have been issued by Ecology and apply to work scope as described in this EII.

4.2.1 Sand plug

Clean sand may be placed across individual aquifers in place of grout as plugging material. The sand shall be placed from the bottom of an aquifer to approximately 2 feet (0.6m) within an upper confining strata or above static water level. Where applicable, appropriate grout materials shall be placed between sand plugs to ensure isolation between individual aquifers.

Natural fill may be left in place as final plug in decommissioning unless it bridges multiple aquifers, in which case it must be removed to ensure isolation of aquifers. If not possible because of borehole conditions, a variance shall be requested in accordance with WAC 173-160.

4.2.2 Grout seal

Based on field conditions and in compliance with WAC 173-160 or variance approved by Ecology, a grout seal consisting of bentonite (granules, pellets or grout), bentonite/cement slurry, or neat cement shall be placed, at the Field Team Leader/Drilling Engineer's (FTL/DE) discretion, above the sand plug to restrict migration of cement through the sand or formation to the groundwater.

4.2.3 Pressure grouting

Seal material (bentonite, bentonite/cement, neat cement slurries) shall be placed by pressure grouting to within approximately 3 feet of ground surface.

Pressure grouting means to apply pressure to force the grout into the formation through the perforations in the casing. The FTL/DE will determine packer placement and acceptable grouting pressure based on field conditions. For example, the formation may take grout and not attain pressure buildup beyond hydrostatic pressure.

4.2.4 Surface protection

Remove surface pads and posts (if present). Cut off any remaining casing at least 3 feet (0.91m) below ground surface. Top off well with grout, allowing grout to spread out in excavation to create a grout cap. Scribe well identification number into the grout cap or use brass survey marker if available. Backfill the excavation with native soil and compact.

4.3 Location of Decommissioned Wells

Document location of all decommissioned groundwater wells to enable return if required. Use existing surveys *for horizontal and vertical coordinates*, if available. Horizontal coordinates are to be reported in Hanford plant coordinates and/*or* Washington State (south zone-NAD83) Lambert coordinates for each decommissioned well. *A global positioning system (GPS) may be used to obtain latitude, longitude, and altitude coordinates if no other data is available.*

4.4 Waste Management and Minimization

1. Minimize production of solid waste.

2. Dispose of nonradioactive nonhazardous solid waste in accordance with WHC-CM-7-5, Section 7.3.

3. Manage waste generated from well decommissioning in accordance with EII 4.2 or EII 4.3 of this manual as applicable.

4. Well casing is to be perforated as required and grouted in place unless casing removal has been identified as a requirement for remediation in the evaluation process of EII 6.6.

4.5 Control of Work

Control of work refers to the administrative authority for beginning, planning, scheduling, performing, documenting and evaluating work activities. Requirements for control of work applicable to activities covered by this EII are specified in Section 6.0.

4.6 Equipment

1. Equipment required for decommissioning of wells are those downhole tools normally found associated with drilling industry rigs.

2. Equipment used for this activity does not require calibration.

4.7 Material

Material used in abandonment activities shall meet the minimum requirements of WAC 173-160-415.

4.8 Training and Qualification

1. Training and qualification shall be documented and records shall be maintained as required by EII 1.7.

2. All decommissioning work is to be done by, or under the direct supervision of, an individual possessing a valid Washington State Water Well Construction Operator License.

4.9 Safety Requirements

Appropriate safety documentation shall be prepared and approved before activities may begin. All personnel shall be trained in the applicable safety requirements.

All activities associated with hazardous waste sites and Radiologically Controlled Areas (RCA) must comply with the applicable site-specific safety requirements for access control; monitoring of radiation and environmental hazards; and personal protective equipment.

Those requirements may include a Hazardous Work Permit, site-specific safety plan and Radiation Work Permits (RWP).

4.10 Evaluation Checklist

An evaluation checklist package for wells requiring abandonment must be prepared according to EII 6.6 and approved before starting decommissioning activities.

4.11 Equipment Decontamination

Decontamination/cleaning of drill rig and down-hole equipment is not required when decommissioning groundwater supply wells or oil and gas wells that are not located in hazardous or potentially hazardous areas. Decontamination/cleaning shall meet the minimum requirements of EII 5.4.

4.12 Start Card

1. The Notice of Intent to begin well construction, "start card" must be filed with the Washington Start Department of Ecology (Ecology) in accordance with WAC-173-160-055, "Well Construction Notification (start card). Start cards are to be filed with the Kennewick Office of Ecology at least 72 hours before commencement of work.

2. WAC-173-160-055 requires that start cards be submitted for abandonment of a well. Abandonment is equivalent to the decommissioning activities defined in this EII.

3. DOE/RL has delegated the necessary authority to WHC to ensure timely and proper submittal of start cards before groundwater well decommissioning at the Hanford Site.

4. Start card information shall be provided to WHC at least five working days before the initiation of any decommissioning. Information must include well location (township, range, section and 1/4 section), proposed use, approximate start and completion dates, contractor's registration number (if applicable), driller's name and license number (if known) and drilling company's name.

5. The *Well Services* support function of WHC will coordinate start card submittals for all RCRA and CERCLA wells decommissioned at Hanford.

5.0 PROCEDURE

Cognizant Manager	1. Assign Field Team Leader/Drilling Engineer (FTL/DE).
FTL/DE	2. Obtain all approvals: complete or verify completion of required activities. Enter completion date and attach objective evidence of completion for each activity on the Groundwater Well Remediation/Decommissioning Checklist, A-6000-472. NOTE: Photocopies of applicable activity documentation are acceptable objective evidence.
FTL/DE	3. Plan well decommissioning activities, including details such as grout pressures, perforation intervals, materials, and order of work.
Cognizant Manager (or designee)	4. Review Work Planning/Initiation part of the Groundwater Well Remediation/Decommissioning Checklist. Approve if appropriate.
	5. Authorize startup of decommissioning activities.
FTL/DE	6. Notify the decommissioning contractor to mobilize; provide technical direction to decommissioning field personnel; ensure that activities are performed in accordance with WAC 173-303 and applicable Ecology guidance and waivers.
	7. Closely monitor and direct decommissioning contractor for conformance to requirements. NOTE: The FTL/DE has work stoppage authority.
	8. Prepare and submit nonconformance reports when work is not in conformance with requirements.

9. Document decommissioning activities daily on the Field Activity Report (FAR) Well Remediation and Abandonment, BC-6000-287 and appropriate continuation page if necessary.

Cognizant Manager (or designee)

10. Review documentation within five working days.

11. Prepare and distribute (via internal memo or external letter as applicable) the cross-section drawing (informal sketch) showing final condition of the decommissioned well; include related documentation. Distribute to the Hanford Well Administrator, identified users, and concerned organizations.

12. Complete the Water Well Report in accordance with WAC 173-160-050 and transmit to Ecology within thirty days of completing remediation.

13. Prepare the Work Performance/Evaluation part of the Groundwater Well Remediation/Decommissioning Checklist.

14. Approve checklist.

    NOTE: The completed checklist and objective evidence package ensures that the documents needed to support the activities have been completed.

5.5 Records

Record processing and disposition is as follows:

Name, Filing Unit Title or Description	Record Type*	Retention Period	Disposal Authority	Cut-off and Retirement Instructions
FAR: Well Remediation and Abandonment (BC-6000-287)	QA	TBD	TBD	Transmit to FC upon completion for submittal to IRM permanent storage per approved RIDS. FC places copy in project file.
Groundwater Well Remediation/ Decommissioning Checklist (A-6000-472)	QA	TBD	TBD	Transmit to FC upon completion for submittal to IRM permanent storage per approved RIDS. FC places copy in project file.

* QA = Quality Assurance

6.0 FORMS

Field Activity Report - Well Remediation and Abandonment (BC-6000-287, Siteforms)
Groundwater Well Remediation/Decommissioning Checklist (A-6000-472, Siteforms)

7.0 DESIGNATED REVIEWING ORGANIZATION

The organization designated to review changes to this document is listed below.

Designated Reviewers	CMPOC
Hanford Technical Services, process owner	*STS/HTS*

Comments from other organizations are welcome; however, such courtesy comments are dispostioned at the option of the originating organization.

8.0 REFERENCES

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells."

WAC 173-162, "Regulations and Licensing of Well Contractors and Operators."

WHC-CM-7-5, *Environmental Compliance.*
Section 7.3, "Standards for Nonradioactive Nonhazardous Solid Waste Disposal."
Section 8.0, "Water Quality."

WHC-SD-EN-AP-122, "Hanford Well Remediation and Decommissioning Plan."

9.0 BIBLIOGRAPHY

ECOLOGY, 1993, C. Cline, Ecology to J. Hennig, RL, "Request of Variance from WAC 173-160-415 to Install Sand Plugs in Aquifers During Well Abandonment/Decommissioning and Remediation Activities." May 5, 1993.

WHC-CM-4-3, *Industrial Safety Standards*, Volume 1, "Safety Standards."
Standard A-3, "Prejob Safety Planning/Job Hazard Analysis."
Standard CM-9, "Surface Drilling."
Standard G-10, "Controlling Access to Unoccupied Facilities."

WHC-CM-6-1, *Standard Engineering Practices*, EP-1.2, "Engineering Specification Requirements."

WHC-CM-7-5, *Enviromental Compliance.*
Section 12.2, "Historical and Archaeological Site Preservation."
Section 12.4, "Plant and Wildlife Species on the Hanford Site."

WHC-CM-8-7, *Operations Support Services*, Section 503.1, "Excavation Permits."

1.0 PURPOSE

This Environmental Investigations Instruction (EII) specifies responsibilities and work control methods for remediation activities at existing groundwater wells on the Hanford Site.

Remediation of individual groundwater wells may be necessary to allow the well to be used for alternate purposes, preclude migration of contaminants into or between aquifers, or allow continued use of the well for its intended purpose.

2.0 SCOPE

This EII applies to the remediation (repairing or altering the structure) of existing groundwater wells on the Hanford Site.

3.0 RESPONSIBILITIES

3.1 Cognizant Manager

1. Assign the Field Team Leader (FTL)/Drilling Engineer (DE).

2. Review required documentation and authorize start of remediation activities.

3.2 Field Team/Drilling Engineer

1. Plan groundwater well remediation activities.

2. Interface with the remediation service contractor.

3. Provide onsite technical direction of contractors.

4. Ensure completion of field activities as required by WAC 173-160 and applicable specifications.

5. Document field activities.

6. Ensure that required documentation and records are properly completed, approved, and controlled.

4.0 REQUIREMENTS

4.1 Groundwater Protection

Requirements for groundwater well installation and use are contained in WHC-CM-7-5, Section 8.3.7. Those requirements are:

1. Groundwater monitoring wells shall be constructed in accordance with the relevant requirements of WAC 173-160 and WAC 173-162.

2. Groundwater monitoring wells shall be operated in accordance with WAC 173-162 and the relevant requirements of WAC 173-160 for resource protection wells.

4.2 Functional Design Requirements

Functional design requirements for use of existing wells are developed based on approved decisions reached under the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement).

4.3 Technical Requirements

Technical requirements are contained in engineering specifications for well remediation prepared according to WHC-CM-6-1, EP-1.2, as required by remediation activities. Activities may consist of changes to existing structures or complete remediation equivalent to new monitoring well construction.

4.4 Waste Management And Minimization

1. Production of solid waste shall be minimized.

2. Nonradioactive, nonhazardous solid waste shall be disposed of in accordance with WHC-CM-7-5, Section 7.

3. Waste generated from well remediation will be managed in accordance with EII 4.2 or EII 4.3 of this manual, as applicable.

4. Well casing shall be perforated as required and grouted in place unless casing removal has been identified as a requirement for remediation in the evaluation process of EII 6.6 of this manual.

4.5 Control of Work

Control of work refers to the administrative authority for beginning, planning, scheduling, performing, documenting, and evaluating work activities. Control of work requirements applicable to activities covered by this EII are specified in Section 6.0.

4.6 Equipment

1. Equipment required for remediation of groundwater wells are those tools normally associated with water well industry drilling rigs.

2. No equipment used for this activity requires calibration.

4.7 Measurements

1. Well depth and remediation modifications shall be measured to $\pm$ 0.1 ft (0.03m) using standard steel engineering scale measuring tapes.

2. All measurements shall be related to the common datum of ground surface, which shall be established at existing ground surface level prior to remediation activities.

4.8 Well Location

Location of all remediated groundwater wells shall be determined by onsite survey. Exiting surveys may be used where available and applicable. The survey requirements are found in WHC-S-0115.

4.9 Training And Qualifications

1. Training and qualifications shall be documented and records shall be maintained as required by EII 1.1 and 1.7 of this manual.

2. All remediation work is to be performed by, or under the direct supervision of, an individual possessing a valid Washington State Water Well Construction Operator License obtained in accordance with WAC 173-162.

4.10 Safety Requirements

All remediation activities shall comply with the requirements of the applicable site-specific safety documents, (e.g., HWOP, JSA, site-specific safety plan), and Radiation Work Permit (RWP) for access control, monitoring of radiation, health and safety hazards, and personal protective equipment.

4.11 Evaluation Checklist

An evaluation checklist for Wells requiring remediation shall be prepared in accordance with EII 6.6 and properly approved before starting remediation activities.

4.12 Start Card

1. The Notice of Intent to begin well construction, "start card," must be filed with the Washington State Department of Ecology (Ecology) in accordance with WAC-173-160-055, "Well Construction Notification (start card)." Start cards are to be filed with the Kennewick Office of Ecology at least 72 hours before commencement of work.

2. WAC 173-160-055 requires that start cards be submitted for reconstruction of a well. Reconstruction is equivalent to the remediation activities defined at the Hanford Site.

3. DOE/RL has delegated the necessary authority to WHC to ensure timely and proper submittal of start cards before groundwater well remediation at the Hanford Site.

4. Start card information shall be provided to WHC at least five working days before the initiation of any well remediation. Information must include well location (township, range, section and 1/4 section), proposed use, approximate start and completion dates,

contractor's registration number (if applicable), driller's name and license number (if known) and drilling company's name.

5. The *Well Services* support function of WHC will coordinate start card submittals for all RCRA and CERCLA wells remediated at Hanford.

5.0 PROCEDURE

5.1 Work Planning/Initiation

5.1.1 Environmental Readiness Review

The FTL/DE shall prepare a Well Remediation Readiness Checklist, A-6001-365 (Figure 1) and conduct of operation matrix as required in EII 1.13 of this manual. The conduct of operation matrix may include more than one well when applicable.

The FTL/DE obtains all approvals and completes or verifies completion of required activities for individual wells by initiating and entering the completion date for each activity on the checklist.

5.1.2 Work Authorization

The cognizant manager (or designee) reviews the checklist and conduct of operation matrix for completeness. Approval indicates authorization to proceed.

5.2 Mobilization

The FTL/DE notifies the remediation services contractor to mobilize after Section 5.1 has been completed and approved.

5.3 Work Performance and Review

1. The FTL/DE closely monitors and directs the remediation services contractor doing remediation work for conformance to specifications.

2. The FTL/DE has work stoppage authority.

3. Engineering Change Notices (WHC-CM-6-1, EP-2.2) are initiated when revisions to the specifications are required.

4. Nonconformance Reports (WHC-CM-4-2, QI 15.1) are prepared when work is not in conformance with requirements.

5. Remediation activities shall be documented daily on the Field Activity Report (FAR) - Well Remediation and Abandonment. The Text Continuation Page and Drawing Continuation Page are used when required.

5.4 Work Evaluation

The FTL/DE assembles completed FARs and other records generated during remediation. The cognizant manager (or designee) reviews the records for completeness.

5.4.1 Well Condition Drawing

The FTL/DE prepares and distributes (via internal memo or external letter as applicable) the cross-section drawing (informal sketch) showing final condition of the remediated well and other related documentation deemed necessary to the geosciences, hydrology, and engineering groups who direct work, or who need information.

5.4.2 Well Completion Report

The FTL/DE ensures that the Water Well Report/Resource Protection Well Report (WAC 173-160-050, "Records") has been properly completed and transmitted to Ecology within 30 days of completing remediation.

5.4.3 Well Remediation Verification Report

The FTL/DE completes the Well Remediation Verification Report, A-6001-364 (verification report, Figure 2). The cognizant manager then approves the completed verification report.

5.5 Records

Processing and disposition of records generated during implementation of this EII are as described

Name, Filing unit title or description	Record Type*	Retention Period	Disposal Authority	Cut-off and Retirement Instructions
FARS: Well Remediation and Abandonment, Text Cont. Page, Drawing Cont. Page, Tubular Goods Tally Cont. Page , Cement Calculations - Cont. Page	QA	TBD	TBD	Transmit to FC upon completion for submittal to IRM permanent storage per RIDS. FC places copy in project file. Continuation pages are transmitted when used.
Well Remediation Readiness Checklist, Well Remediation Verification Report, Conduct of Operation Matrix	QA	TBD	TBD	Transmit to FC upon completion for submittal to IRM permanent storage per RIDS. FC places copy in project file.
Nonconformance Reports (NCRs)	QA	TBD	TBD	When applicable, transmit to FC upon completion for submittal to IRM permanent storage per RIDS. FC places copy in project file.

* QA = Quality Assurance; TBD = To be determined

6.0 FORMS

The following forms and instructions are available on Siteforms.

FAR - Well Remediation and Abandonment (BC-6000-287)
FAR - Cement Calculations - Continuation Page (BC-6000-279)
FAR - Drawing Continuation Page (BC-6000-281)
FAR - Tubular Goods Tally - Continuation Page (BC-6000-281)
Groundwater Well Remediation/Decommissioning Checklist (A-6000-472)
Well Remediation Readiness Checklist (A-6000-365)
Well Remediation Verification Report (A-6000-364).

7.0 DESIGNATED REVIEWING ORGANIZATIONS

Organizations designated to review changes to this document are listed below.

Designated Reviewers	CMPOC
Documentation and Records Services	IRM/DRM
Hanford Technical Services, process owner	*STS/HTS*

Comments from other organizations are welcome; however, such courtesy comments are dispositioned at the option of the originating organization.

8.0 REFERENCES

Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement).

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells."

WAC 173-162, "Regulation and Licensing of Well Contractors and Operators."

WAC 173-303, "Dangerous Waste Regulations."

WHC-S-0115, *Specification for Remediation of Existing Resource Protection Wells,*

WHC-CM-3-5, *Records Management and Document Control*, Section 5, "Records Storage, Retrieval, and Destruction."

WHC-CM-4-2, *Quality Assurance Manual*, QI 15.1, "Nonconforming Item Reporting."

WHC-CM-6-1, *Standard Engineering Practices.*
EP-1.2, "Engineering Specification Requirements."
EP-2.2, "Engineering Document Change Control Requirements."

WHC-CM-7-5, *Environmental Compliance.*
Section 7, "Solid Waste Management."
Section 8, "Water Quality."

9.0 BIBLIOGRAPHY

WHC-CM-2-5, *Management Control System*, Section 2.5, "External Work Orders."

WHC-CM-4-3, *Industrial Safety Manual*, Volume 1, "Safety Standards."
Standard A-3, "Prejob Safety Planning/Job Hazard Analysis."
Standard CM-9, "Surface Drilling."
Standard G-10, "Controlling Access to Unoccupied Facilities."

WHC-CM-4-11, *ALARA Program Manual.*

WHC-CM-4-40, *Industrial Hygiene Manual*, Section 3.1, "Confined Spaces Entry."

WHC-CM-4-46, *Nonreactor Facility Safety Analysis Manual*, Section 4.0, "Hazard Classification."

WHC-CM-7-5, *Environmental Compliance*.
Section 4.0. "National Environmental Policy Act/State Environmental Policy Act."
Section 12.3, "Historical and Archaeological Preservation."
Section 12.4, "Plant and Wildlife Species on the Hanford Site."

WHC-CM-8-7, *Operations Support Services*, Section 503.1, "Excavation Permits."

Figure 1. Well Remediation Readiness Checklist, A-6001-365.

WELL REMEDIATION READINESS CHECKLIST
Criteria from applicable requirement documents

Page 1 of 1

Well No.

Well Specification/Revision WHC-S-0115, Rev. 0

Work Initiation Activity	Requirement Document - Section	Completion Date or NR Initials/Date
Evaluation Checklist Approved	WHC-CM-7-7, EII 6.6	
Engineering Specification Issued	WHC-CM-6-1, EP 1.2	
Cultural Resources Review/Clearance	WHC-CM-7-5, 12.3	
Endangered Species Review/Clearance	WHC-CM-7-5, 12.4	
Env Assessment/NEPA Documentation	WHC-CM-7-5, 4.0	
HWOP/Site Safety Plan Complete	WHC-CM-4-3 Vol 4/WHC-CM-7-7, EII 2.1	
Radiation Work Permit Obtained	WHC-CM-1-6	
Hazard Classification Complete	WHC-CM-4-46, 4.0	
Retired Area Entry Permit Obtained	WHC-CM-4-3, G-10	
ALARA Checklist Complete	WHC-CM-4-11	
Evacuation Permit Obtained	WHC-CM-4-3, CM-8/WHC-CM-8-7, 503.1	
Confined Space Entry Permit Obtained	WHC-CM-4-40, 3.1	
Jet Perforation Planned/Controlled	WHC-CM-4-3, CM-11	
Personnel Training Complete	WHC-CM-7-7, EII 1.1	
Procedures Revised	WHC-CM-7-7, EII 1.2, EII 1.4	
Conduct of Operations Matrix Complete	WHC-CM-7-7, EII 1.13	
Work Schedule Complete	WHC-CM-7-7, EII 1.14	
Letter of Instruction Issued	WHC-CM-6-2, PM-10, WHC-CM-7-7, EII 1.15	
Authorization Work Order Issued	WHC-CM-2-5, 2.5	
Remediation Rig/Tools Inspected	WHC-S-0115, 0110-1.6	
Start Card Transmitted	WAC-173-160-055/WHC-CM-7-7, EII 8.3	

NR = Not Required

Comments

Checklist Completed By:

Print/Sign Name and Date

Checklist Approved By:

Print/Sign Name and Date

A-6001-365 (06/94)

Figure 2. Well Remediation Verification Report, A-6001-364.

WELL REMEDIATION VERIFICATION REPORT
Criteria from WHC-S-0115, and applicable change documents

Page 1 of 1

Well No.	Well Specification/Revision	Remediation Plan Number
	WHC-S-0115, Rev. 0	

Subject	Verification Method	Criteria: Specification Section	Criteria: Chg. Doc.	Completion Date or NR Initials/Date
Cleaning				
Remediation Rig/Tools	Visual	01100-1.7.1.8		
Temporary Materials	Visual	01100-1.7.1.8		
Lubricants/Additives				
Lubricants	Visual	01019-1.3.2.5.2		
Additives	Visual	01019-1.3.2.5.1		
Remediation Materials				
Liner Casing	Visual	02670-2.4		
Casing Centralizers	Visual	02670-2.4		
Screens	Visual	02670-2.5		
Cement Grout	Visual	02670-2.1		
Well Cap	Visual	02670-2.6		
Concrete for Pad	Visual	02670-2.1		
Storage/Packaging	Visual	01600-1.3.1		
Site Preparation	Visual	02110-3.1		
Casing Perforations	Visual	02670-3.1		
Liner/Grout Installation	Visual/Calculation	02670-3.1		
Overdrill/Grout Installation	Visual/Calculation	02670-3.1		
Surface Pad Installation	Visual	02670-3.4		
Protective Post Installation	Visual	02670-3.5		
Cap/Hasp/Lock Installation	Visual	02670-3.6		
Casing Extended/Cutoff	Visual	02670-3.7		
Casing Exterior/Posts Painted	Visual	02670-3.8		
Labeled/BC-Casing Stamped	Visual	02670-3.5		
Survey Complete	Visual	01050-2.1		
Site Restored	Visual	02670-2.9		
Waste Controlled	Visual	01100-1.9, 1.10		
Well Record to Ecology	Visual	01300-1.2.1.8		

NR = Not Required

Comments ______________________________

Report Completed By: ______________________
Print/Sign Name and Date

Report Approved By: ______________________
Print/Sign Name and Date

A-6001-364 (07/94)

INSTRUCTION CHANGE AUTHORIZATION		ICA No. 083
Instruction (EII) No. EII 9.1, Geologic Logging	Rev. No. 3	Page 1 of 1

Description of Change

Impact Level 3Q

Page 2, section 5.1, Completion of the Borehole Log, revise the first sentence as follows:

In addition, detailed Geologic Logging may be conducted following completion of the drilling operation (sonic only).

NOTE: This ICA applies only to wells and boreholes currently being drilled using the Sonic Drilling method under the Cooperative Research and Development Agreement (CRADA) program.

[X] One Time [] Permanent

Justification

The Sonic Drilling method uses lexan liners to hold earthen materials. It is difficult for the geologist to accurately log the material through the liner. In order to log the material the liners are cut open along the length of the core. Due to the relatively high drilling rate the cores are labeled and set aside for later detailed examination. Delaying the detailed logging of the cores will allow the geologist to obtain better lithologic information.

Approvals: (Type/Sign Name and Date)

D. C. Weekes DC Weekes	12/22/93	A. J. Knepp A. J. Knepp	12-22-93
ICA Author	Date	ICA Author's Manager	Date
K. R. Fecht KR Fecht	12/22/93	W. R. Thackaberry WR Thackaberry	12-22-93
EII Author's Manager	Date	Quality Assurance (If Required)	Date
		N/R	
		Safety (If Required)	Date

1.0 PURPOSE

The purpose of this Environmental Investigations Instruction (EII) is to establish methods and documentation format for geologic logging of boreholes in soil and consolidated materials.

2.0 SCOPE

This EII applies to the geologic logging of boreholes drilled by Westinghouse Hanford Company (WHC) or subcontractors in accordance with contract documents for geologic sampling, installation of wells, installation of instrumentation or other reasons. It also applies to holes drilled in rock formations (e.g., basalt flows). Relogging of previously drilled material is not covered by this procedure.

This EII may also be used to describe and classify geologic materials regardless of how samples are obtained including pit and trench sampling.

3.0 RESPONSIBILITIES

3.1 Well Site Geologist

1. Making detailed geologic observations during borehole construction.

2. Describing and logging samples.

3. Completing the Borehole Log and Well Summary Sheet in compliance with the requirements of this EII.

4.0 PROCEDURE

The sections in this logging procedure are not necessary for every sample in a given boring nor is the number sequence relevant.

3.1 Completion of the Borehole Log

Geologic logging shall be conducted concurrently with the drilling operation for each shift. Logs shall be completed for each shift. Borehole Logs (A-6000-382) shall contain the following:

1. Borehole or well number (permanent, if known) and sheet number.

2. Location (descriptive location) and project identification.

3. Geologist's name (prepared by), signature and date.

*Editorial and reformatting are the only changes to Rev 3, Change 2.

4. Reviewer's name (reviewed by), signature and date.

5. Depths to sample intervals. Record to nearest 0.1 foot if split spoon is used, otherwise record to nearest foot. Delineate depth on depth scale.

6. Number and type of samples retrieved (e.g., split spoon, drive barrel). If split spoon is run; percent recovery, and top and bottom depths should be recorded.

4.1.1 Geologic Logging Information

Grain size nomenclature describing geologic material from the borehole shall be in accordance with Table 1 (modified Folk) and Table 2, unless specifically directed by the work plan or groundwater monitoring plan. Health and safety restrictions may also determine the amount of information collected from the borehole material. All new material from the borehole should be examined by the geologist. Detailed descriptions should be made at major lithologic changes. All depths are from ground surface unless otherwise noted. The following items may be determined for each sample:

1. Graphic representation of stratigraphy using Figure 1 as a guideline.

2. Soil types and narrative sample descriptions:

   a. Soil type name. Use Tables 1 and 2 to determine grain size percentage and soil type.

   b. Soil color. Use the Munsell soil color chart as a guide. Natural moisture color should be obtained. If the color represents a dry or wet condition, state it in the log.

   c. Moisture content (e.g., dry, moist, wet) in accordance with Table 3.

   d. Sorting estimate from Figure 2.

   e. Particle angularity. In accordance with Table 4. Describe the angularity of sand (coarse sizes only), gravel, cobbles, and boulders. A range of angularity may be stated, such as subangular to angular.

   f. Minor soil constituents. Descriptive adjectives for minor soil constituents (e.g., mica). When descriptive adjectives are used, include estimates of percentages.

   g. Lithology. Lithology of gravel and sand (e.g., basalt, quartz, feldspar). Estimate percentages of constituents (e.g., sand is 40% basalt and 60% quartz and feldspar). Separate lithologic estimates should be made for gravel and sand fractions.

   h. Maximum particle size. Record the maximum size particle found in the sample.

i. Carbonate content. Presence of carbonate as indicated by relative reaction with dilute hydrochloric acid; estimate from Table 5.

j. Other appropriate information. These may include fractures, cementation, facies type, secondary precipitates such as gypsum and carbonate, iron stain, solution cavities, stratification, discontinuities, water-bearing zones, organic content, field screening instrument readings including instrument type and identification number and any suspected contaminants.

3. Depth to apparent water table, if encountered, using an electric tape or steel tape; record at the beginning of the shift to the nearest 0.1 foot, before drilling starts. Note reference point and measuring point. Decontaminate tape between different boreholes to preclude cross contamination.

4. If more than 5% of the soil is finer than 0.062 mm (very fine sand) and is workable, the plasticity (putty-like properties) of the fine fraction should be estimated, if possible; and recorded, see Table 6. Plasticity is not deemed necessary unless the fines are relatively easy to separate. If material can be rolled into a thread, it is considered plastic. The geologist should determine whether the fines are silt or clay. Clay can be made to exhibit plasticity and exhibits considerable strength when air-dry. Silt is nonplastic or very slightly plastic and exhibits little or no strength when air-dry. Dry strength and dilatancy tests may be performed.

5. Record drilling progress systematically and sequentially including details relevant to drilling rate, casing size and type, bit size, depth of casing and water level; relevant anomalies should also be documented. If drilling observations are recorded elsewhere (e.g., Field Activity Report), it is not necessary to record it on the borehole log.

6. Depth of hole (to nearest 0.1 foot) and depth of casing upon reaching total depth.

4.2 Completion of the Well Summary Sheet

The Well Summary Sheet (A-6000-384) is used to record general lithology and construction data in a concise format using Figure 3 as a guideline. The Well Summary Sheet is used for boreholes and wells, and typically contain the following information:

1. Borehole or well number (permanent, if known) and sheet number.

2. Location (descriptive location) and project identification.

3. Geologist's name(s) (prepared by) and date page completed.

4. The following items identify brief descriptions of the construction data that may be recorded (not all inclusive):

   a. Type and diameter of temporary casing used in borehole.

b. Bottom of temporary casing (in feet below ground surface).

c. Use of casing shoe.

d. Hole diameter (if no temporary casing used).

e. Construction diagram showing temporary casings in borehole, permanent casings, and annular seal (or backfill material).

5. Depth in feet (or meters).

6. The following items identify brief descriptions of the geologic/hydrologic data that may be recorded (not all inclusive):

a. General graphic log of lithology.
b. General lithologic description.
c. Depth to water (in feet below ground surface) and location of any high moisture zones.
d. Total depth of the borehole.

4.3 Records

Record processing and disposition is in accordance with the following:

Name, Filing Unit Title or Description	**Record type**	**Retention Period**	**Disposal Authority**	**Cut-off and Retirement Instructions**
Borehole Logs (A-6000-382)	QA	TBD	TBD	Upon completion transmit to FC. FC places copy in appropriate project file and transmits record copy to permanent storage in accordance with approved RIDS.
Well Summary Sheet (A-6000-384)	R	TBD	TBD	Upon completion transmit to FC for inclusion in project file, maintain and disposition in accordance with approved RIDS, pending development of Environmental Record Schedules.

QA = Quality Assurance; R = Other Record Material; TBD = To Be Determined

5.0 DESIGNATED REVIEWING ORGANIZATION

The organization designated to review changes to this document is Hanford Technical Services (HTS), the process owner. Comments from other organizations are welcome; however, comments are dispositioned at the option of HTS.

6.0 REFERENCES

WHC-CM-3-5, *Document Control and Records Management Manual*, Section 5, "Records Storage, Retrieval, and Destruction."

"Journal of Geology," Folk, R.L., Vol. 62, pages 345-351, 1954.

"Manual of Field Geology," Compton, R.R., 1962

7.0 BIBLIOGRAPHY

Munsell Soil Color Chart (1975). Munsell Color. Baltimore. Maryland.

Figure 1. Lithologic Symbols for Borehole Log and Well Summary Sheet.

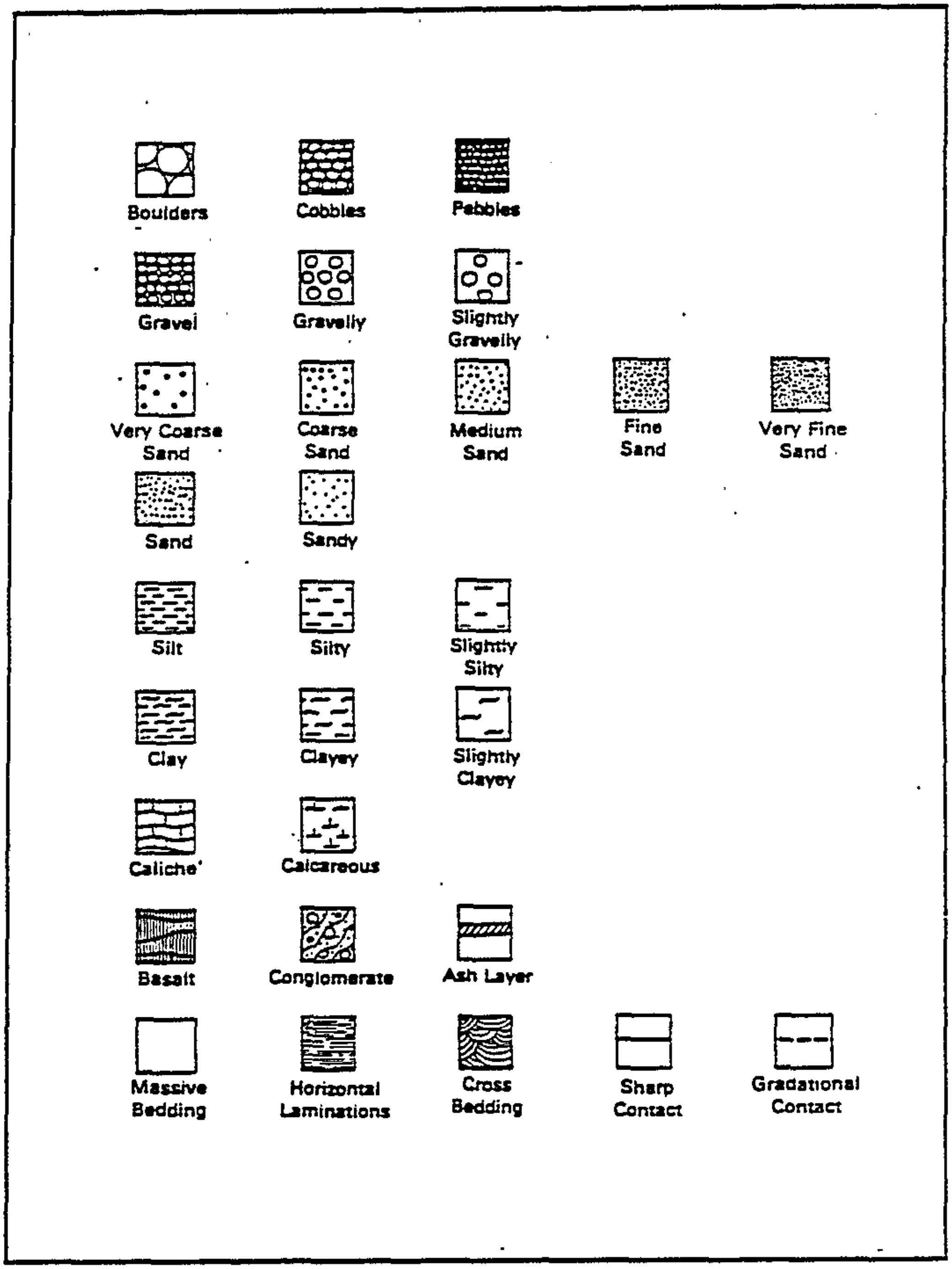
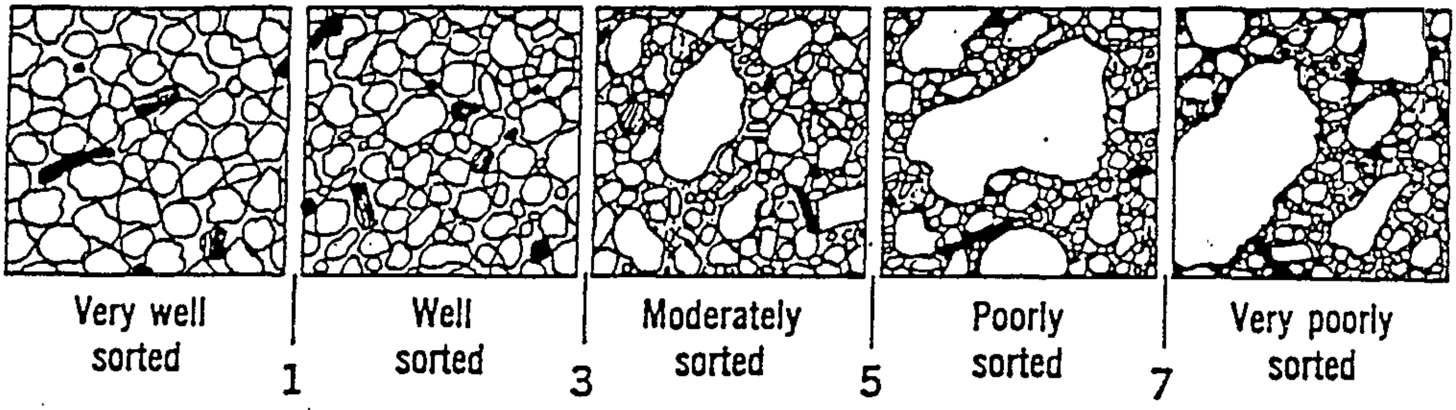


Figure 2. Terms for Degrees of Sorting.



The numbers indicate the number of size classes included by the great bulk (80) of the material. The drawing represent sediments as seen with a hand lens.

Taken from: Compton, R.R., 1962, "Manual of Field Geology."

Figure 3. Well Completion Symbols for Well Summary Sheet.

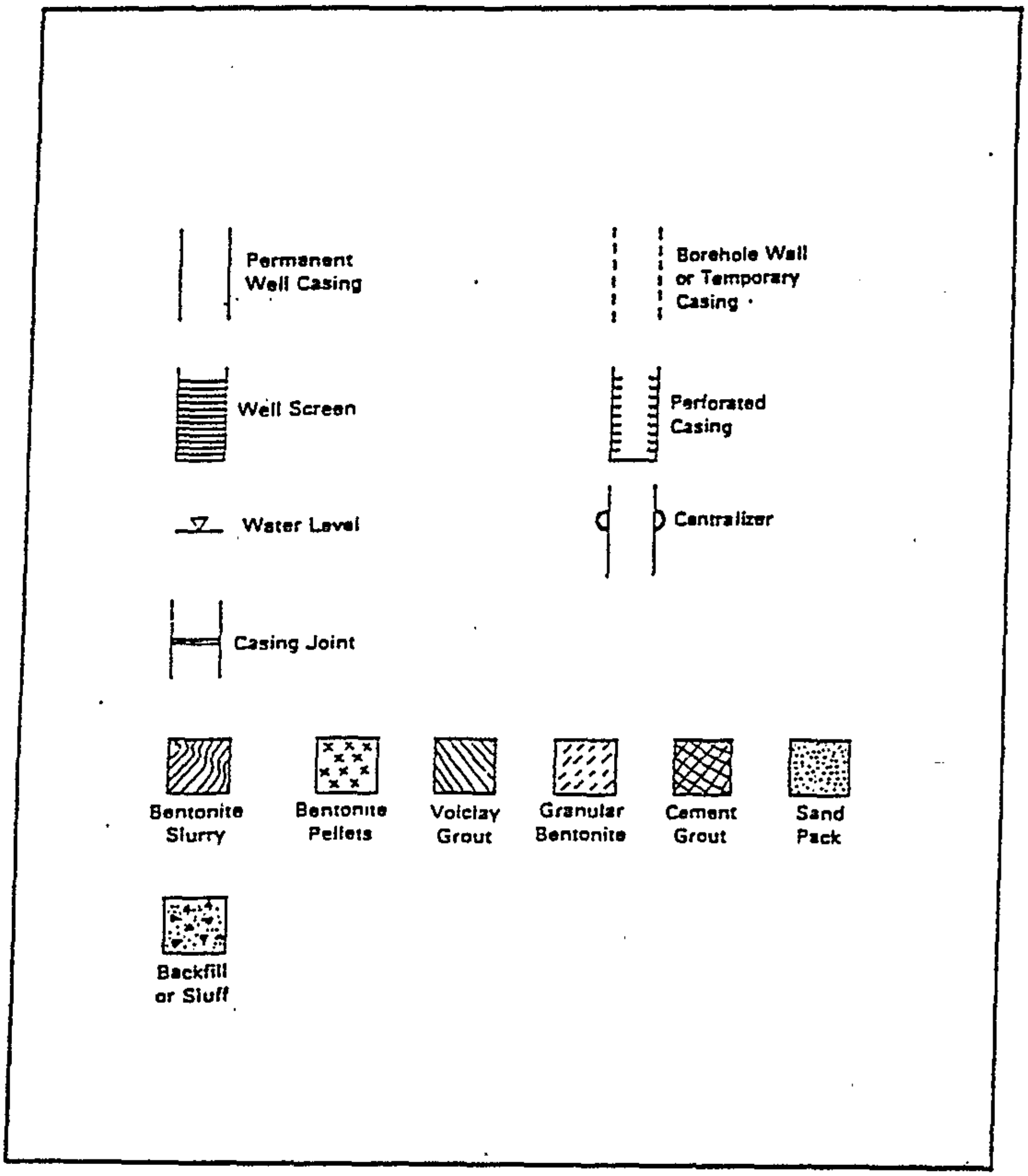
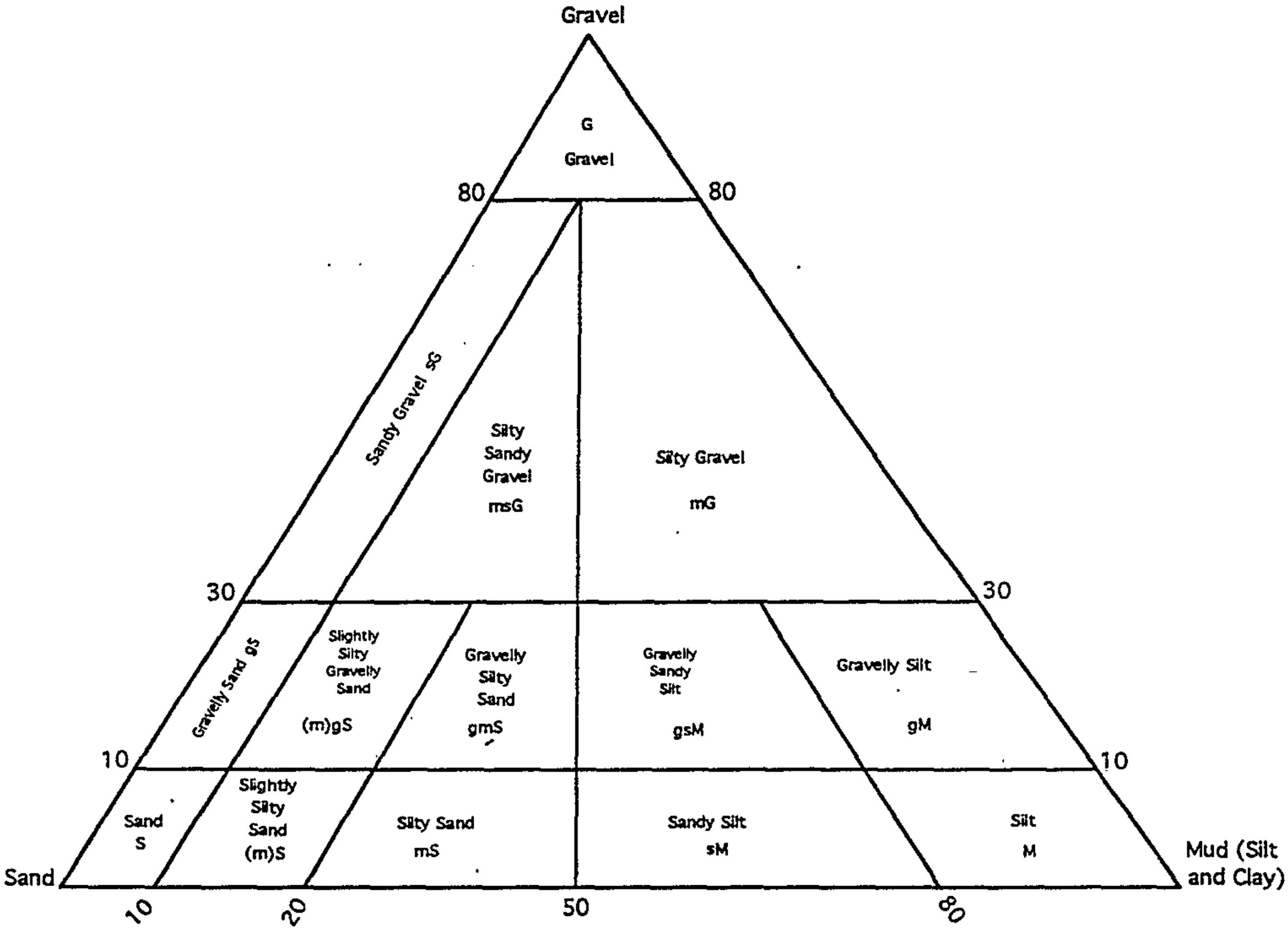


Table 1. Soil Classification Scheme.



Modified from: Folk, R. L., 1954 Journal of Geology (Volume 62, P. 345-351)

Table 2. Grain Size Nomenclature.

Particle Designation		Particle Diameter (mm)
	Boulder	>256
Cobble	large	256-128
	small	128-64
Pebble	very coarse	64-32
	coarse	32-16
	medium	16-8
	fine	8-4
	very fine	4-2
Sand	very coarse	2-1
	coarse	1-0.5
	medium	0.5-0.25
	fine	0.25-0.125
	very fine	0.125-0.0625
Silt/Clay		<0.0625

Table 3. Criteria for Describing Moisture Condition.

Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp, but no visible water
Wet	Visible free water, usually soil is below water table

Table 4. Criteria for Describing Angularity of Coarse-Grained Particles.

Description	Criteria
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular	Particles are similar to angular description but have rounded edges
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges
Rounded	Particles have smoothly curved sides and no edges

Table 5. Criteria for Describing the Reaction with HCl.

Description	Criteria
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

Table 6. Criteria for Describing Plasticity.

Description	Criteria
Nonplastic	A 1/8-in (3-mm) thread cannot be rolled at any water content
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

1.0 PURPOSE

The purpose of this Environmental Investigations Instruction (EII) is to implement requirements for aquifer testing performed in support of environmental investigations.

2.0 SCOPE

This EII applies to slug, constant discharge pumping, *and flowmeter* test methods of aquifer testing performed for site characterization and investigation activities at the Hanford Site. This EII applies to aquifer testing related to the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) activities; however, it may be used for other field investigations.

3.0 DEFINITIONS

See WHC-CM-7-7 Glossary/Acronyms section.

4.0 RESPONSIBILITIES

4.1 Field Team Leader/Cognizant Engineer

The Field Team Leader (FTL) (CERCLA projects) or Cognizant Engineer (RCRA projects), hereafter referred to as the FTL, is responsible for:

1. Directing all field operations from mobilization at the testing site to completion of decontamination and demobilization.
2. Coordinating subcontracted onsite activities.
3. Disposal of purgewater in accordance with EII 10.3 of this manual.

4.2 Aquifer Test Lead

The Aquifer Test Lead is responsible for performing aquifer testing and completing the specified test documentation in accordance with the applicable appendix of this EII.

5.0 REQUIREMENTS

5.1 Safety Requirements

Aquifer testing activities shall comply with the site-specific health and safety documents.

5.2 Pre-test Requirements

Site specific requirements such as test location, discharge disposition, test type, instrument calibration, and test data analysis and interpretation will be provided as needed by individual site Sampling and Analysis Plans, Groundwater Monitoring Plans, or the Aquifer Test Plan.

5.3 Disposal of Discharged Water

Groundwater discharged from the well during aquifer testing shall be disposed of in accordance with EII 10.3.

5.4 Decontamination

Decontamination of downhole test equipment and components shall be conducted in accordance with EII 5.4 and shall occur before and after each testing activity or before testing at a new location.

5.5 Testing Equipment Calibration Status and Function Verification

Equipment calibration status shall be verified prior to use and documented on the appropriate forms or in the field logbook.

6.0 PROCEDURE

This EII is limited to technical activities related to aquifer field test data acquisition. Detailed test methods for individual test types are provided as appendices to this EII, along with specific requirements for recording test data. The methods described in this EII include the slug test (Appendix A), the constant discharge test (Appendix B), *and the K-V Associates Flowmeter (Appendix C).*

7.0 RECORDS

Process records per the following table.

Name, (Filing Unit Title or Description)	Record Type*	Retention Period	Disposal Authority	Cut-off and Retirement Instructions
Instantaneous Slug Test Data Sheet (BD-6000-293) Complete one form for each injection and withdrawal test. Borehole Test Information (BD-6000-295) Complete one form for each injection and withdrawal test Drawdown/Recovery (A-6000-402) 1 completed form for each constant discharge test. Equipment Configuration and Well Head Diagram (A-6000-417) Complete one form for each constant discharge test.	QA	TBD	TBD	Upon completion submit record copy to FC for transmittal to IRM permanent storage within 30 days. Reference copies are maintained in access controlled area(s).
Field Logbooks	QA	TPA + 10 Years (Force Fit)	DRS 1.8.c (Force Fit) TBD	Submit copies to FC on a weekly basis. When no further entries are required at project completion or when no longer needed, submit logbook to FC for transmittal to IRM permanent storage.
Aquifer Test Information Sheet (A-6000-959).	NR	Until information is transferred to field logbook or appropriate form(s).	NR	Destroy in office when information has been transferred to field logbook or appropriate form(s) and is no longer needed.

* QA = Quality Assurance; NR = Nonrecord Material

8.0 DESIGNATED REVIEWING ORGANIZATION

The organization designated to review changes to this document is Hanford Technical Services. Comments from other organizations are welcome; however, such courtesy comments are dispositioned at the option of the originating organization.

9.0 FORMS

Instantaneous Slug Test Data Sheet (BD-6000-293), Jetform
Borehole Test Information (BD-6000-295), Jetform
Drawdown/Recovery (A-6000-402), Jetform
Equipment Configuration and Well Head Diagram (A-6000-417), Jetform
Aquifer Test Information Sheet (A-6000-959), Jetform.

10.0 REFERENCES

WHC-CM-3-5, *Document Control and Records Management*, Section 5, "Records Storage, Retrieval, and Destruction."

Bouwer, H., and Rice, R. C., *Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells*, Volume 12, No. 3, 1976.

APPENDIX A

SLUG TEST METHOD

1.0 DISCUSSION OF METHOD

During a slug test, the water level in a well is instantaneously changed by inserting, removing, or displacing a known volume of water. The subsequent water level response is then monitored.

An Aquifer Test Plan is not required; however, one may be generated to include changes and/or modifications in the slug test equipment requirements or procedure. Otherwise, the slug test must be conducted according to the equipment requirements and procedure set forth in this EII and appendix.

2.0 EQUIPMENT REQUIREMENTS

Aquifer testing equipment may include, but is not limited to, the following. The required specifications listed after each item must be recorded on the Borehole Test Information form BD-6000-295.

1. Pressure transducer. Record the make, model, pressure range, identification number, and calibration date.

2. Weighted water level measuring tape. Record make, model, length, identification number, and standardization date.

3. Pressure recorder. Record make, model, calibration date, and identification number.

4. Slugging rod. Record diameter and length of slugging rod to the nearest 0.01 foot.

5. Electric sounder. Record make, model, length, identification number, and calibration date.

The field instrumentation must be standardized or calibrated as follows:

- Standardized electric tapes. ± 0.10 foot of the calibrated electric tape.

- Calibrated electric tape. ± 0.2 percent over the total tape length, traceable to the National Bureau of Standards.

- Standardized steel tapes. ± 0.10 foot of the calibrated steel tape at a minimum length of 100 feet.

- Calibrated steel tape. ± 0.10 foot at full length for a 300 foot tape; ± 0.15 foot at full length for a 500 foot tape.
- Pressure transducer. ± 0.5 percent of the full scale.

3.0 PROCEDURE

The section describes the test methods to be used in conducting the slug injection or slug withdrawal tests. All information and data collected during the test will be recorded in the field logbook or Aquifer Test Information Sheet, the appropriate field activity report, and/or on forms BD-6000-295 and BD-6000-293. The field activity report and/or the Equipment Configuration and Well Head Diagram, A-6000-417, and Drawdown/ Recovery, A-6000-402, may be filled out directly or later using the information recorded in the field logbook or Aquifer Test Information Sheet. Data from a data logger or data that will not fit on a form will be properly identified and attached to the appropriate form or the field logbook.

NOTE: **Time shall be recorded to the nearest minute using Pacific Standard Time, unless otherwise noted.**

1. Record pretest equipment status: function test, identification information, and calibration due dates.
2. Record the well dimensions.
3. Measure the depth to water in the well using the weighted water level measuring tape or an electric sounder, as directed in EII 10.2. Record depth to water to the nearest 0.01 foot and time. This measurement becomes the reference water level.
4. Install the pressure transducer to a depth below the water level that will not interfere with the lowering or withdrawal of the slugging rod. Record the transducer depth below water line, as indicated by the transducer and data logger.
5. If only a slug withdrawal test will be conducted, place the top of the slugging rod below the expected static water level, and go to step 12. If both slug injection and slug withdrawal tests will be conducted, continue to step 6.
6. After placing the bottom of the slugging rod within ± 0.2 feet of the water level, record the time and begin collecting baseline water level data.
7. Continue collecting baseline data for at least ten minutes, then stop and record the time.
8. Set the data logger sample rate to the log-cycle; the maximum sampling interval will be determined by the Aquifer Test Lead, depending upon the anticipated water level response.
9. Initiate the slug injection test by lowering the slugging rod as quickly as possible to a depth below the water level. Record the time.

10. Continue monitoring the water level until at least 90 percent of the pressure difference imposed by the slug has decayed (Bouwer & Rice, 1976). This requirement may be disregarded, with recorded justification, at the discretion of the Aquifer Test Lead, or if the pressure difference has not sufficiently decayed after 24 hours.

11. Terminate the slug injection test, and record the time.

12. Record the time and begin collecting baseline water level data.

13. Continue collecting baseline data for at least ten minutes, then stop and record the time.

14. Set the data logger sample rate to the log-cycle; the maximum sampling interval will be determined by the Aquifer Test Lead, depending upon the anticipated water level response.

15. Initiate the slug withdrawal test by removing the slugging rod from the water as quickly as possible. Record the time.

16. Continue monitoring the water level until at least 90 percent of the pressure difference imposed by the slug has decayed (Bouwer & Rice, 1976). This requirement may be disregarded, with recorded justification, at the discretion of the Aquifer Test Lead, or if the pressure difference has not sufficiently decayed after 24 hours.

17. Terminate the slug withdrawal test, and record the time.

APPENDIX B

SINGLE AND MULTIPLE WELL DRAWDOWN AND RECOVERY PUMPING TEST METHOD

1.0 DISCUSSION OF METHOD

The single well drawdown and recovery pumping test utilizes one well and a mechanical pump both to stress an underground formation (at an approximately constant rate) and measure the resultant drawdown and recovery. The multiple well test utilizes one or more observation wells to measure the effects of the stress away from the pumped well. In either a single or multiple well pumping test, a step drawdown test is usually conducted prior to the actual aquifer test to obtain information that will help perform the aquifer test. Aquifer testing may be discontinued at a well after the step drawdown pumping test for the following reasons.

1. The step drawdown test itself may constitute a single well pumping test (depending on the way it is conducted) and provide all the necessary data of a single well pumping test.

2. In a multiple well test, the information collected may indicate that the available equipment is not adequate to conduct the test, the hydrogeology is such that collecting meaningful results would be nearly impossible, or the value of the anticipated results are not worth the cost of the effort.

2.0 EQUIPMENT REQUIREMENTS

The following is a general list of required test equipment used in the constant discharge test, mechanical pumping method. The specific description (size, type, model, range, and other specifications) of this equipment may vary depending on well and site conditions. These specifications will be recorded on the Borehole Test Information form (BD-6000-295, Jetform).

1. <u>Mechanical pump</u>. Record type, make, model, identification number, and horsepower rating. The pump should have a characteristic curve available.

2. <u>Flow meter</u>. Record make, model, identification number, and calibration date.

3. <u>Flow regulator</u>. Record type and size.

4. <u>Pressure transducers</u>. Record the pressure range, identification number, and calibration date.

5. <u>Weighted water level measuring tape</u>. Record the identification number and standardization date.

6. <u>Data logger</u>. Record the make, model, and identification number.

7. Appropriate reservoir. An appropriate reservoir of adequate size to contain all pumped water, if required by the applicable Effluent Control Plan.

8. Electric sounder. Record make, length, identification number, and calibration/standardization date(s).

9. Check valve. Record if a check valve is in place.

The field equipment must be calibrated or standardized as follows:

- Standardized electric tapes. ± 0.10 foot of the calibrated electric tape.
- Calibrated electric tape. ± 0.2 percent over the total tape length, traceable to the National Bureau of Standards.
- Standardized steel tapes. ± 0.10 foot of the calibrated steel tape at a minimum length of 100 feet.
- Calibrated steel tape. ± 0.10 foot at full length for a 300 foot tape; ± 0.15 foot at full length for a 500 foot tape.
- Pressure transducer. ± 0.5 percent of the full scale.
- Flow meters. ± 10 percent of flow.

3.0 PROCEDURE

This section describes the methods used to conduct single or multiple well step drawdown and constant discharge aquifer pumping tests. The procedure also includes recommendations to assist in the development of the Aquifer Test Plan. The Aquifer Test Plan will provide the site specific requirements and instructions for accomplishing each task. The Aquifer Test specifications should include enough flexibility to accommodate the anticipated field conditions. The Aquifer Test Lead orders any changes from the Aquifer Test Plan due to the actual field conditions, those changes must be documented with the justification in the field logbook and by Engineering Change Notice, as applicable.

All information and data collected during the test will be recorded in the field logbook or Aquifer Test Information Sheet, the appropriate field activity report, and/or the Equipment Configuration and Well Head Diagram, A-6000-417, and Drawdown/Recovery, A-6000-402. The field activity report and/or forms A-6000-417 and A-6000-402 may be filled out directly or later using the information collected in the field logbook. Data from a data logger or data that will not fit on a form will be properly identified and attached to the appropriate form or the field logbook.

Note the weather conditions, any unexpected occurrences, or any disturbances located near-by heavy equipment, passing trains, etc.

Procedure Instructions:

Table B-1 summarizes the procedural steps for conducting step drawdown and pumping tests, the necessary equipment and testing information described for each step, and the appropriate data recording forms. This table must be supplemented with the requirements from the applicable Aquifer Test Plan. Table B-2 summarizes the recommended minimum automatic (data logger) monitoring frequencies for each individual step. Manual measurements should be made at the beginning and end of each test; additional measurements may be made at the discretion of the Aquifer Test Lead. The recommendations provided in the tables are considered the default values for each test. The Aquifer Test Plan will stipulate any alternate information, if necessary.

NOTE: Time shall be recorded as Pacific Standard Time, unless otherwise noted.

1. Record pretest equipment status: function test, identification data, and calibration due dates. Also record the well dimensions.

2. Measure the depth to water in the pumping well and any observation wells (in accordance to EII 10.2), and record the time. These measurements are the reference water levels.

3. Install the mechanical pump in the well so as to maximize the amount of available drawdown, or as specified in the Aquifer Test Plan. Record the pump intake depth to within $\pm$ 1.0 foot.

4. Install the pressure transducers in the pumping well and any observation wells. The depth setting of the pressure transducer should be high enough that the maximum pressure measured is within the calibrated range, and deep enough that the maximum expected drawdown is not below the transducer. Record the transducer(s) depth below water, as indicated by the transducer and data logger.

5. Record the time and begin collecting baseline water level data.

6. Continue collecting baseline data for at least ten minutes, or as specified in the Aquifer Test Plan, and then stop and record the time.

NOTE: If no step drawdown test is required, omit steps 7 through 12.

7. Set the data logger sample rate to the log-cycle, the maximum sampling interval will be set by the Aquifer Test Lead.

8. Start the mechanical pump and adjust the valve or flow regulator to maintain the constant rate of discharge specified in the test plan. Record this time as the start of step one of the step drawdown test.

9. Record the time, flow meter readings, and depth to water measurements. The data may be recorded on computer disks and properly identified when the data logger can be accessed. Continue this until directed to begin the next step of the step drawdown test. See Table B-2 for the recommended monitoring and data recording frequencies.

10. At the direction of the Aquifer Test Lead, acting in accordance with the Aquifer Test Plan, initiate the next step. Reset the pressure recorders to their start-up frequencies, and increase the rate of discharge for the new step (do NOT turn off the pump). Record the time of the discharge rate change and the new discharge rate. Continue recording the time, well head flow meter readings, and depth-to-water measurements as described in Table B-2.

11. Repeat procedure step 10 as many times as directed by the Aquifer Test Lead and indicated by the Aquifer Test Plan. In general, the time of each pumping step should be equal in duration to each of the others.

12. To conclude the step drawdown test, reset the data loggers to their start-up frequencies (see Table B-1), shut down the pump, and record the time. This is the end of the step drawdown test and the beginning of the step recovery test. Continue recording time and depth to water measurements until pre-test conditions are reestablished, the water level has stabilized, or a trend is observed by the Aquifer Test Lead (see Table B-2 for recommended minimum recording and monitoring frequencies). If a check valve was in place, check the water level in the pump string to determine and record if the check valve leaked. Based on the Aquifer Test Plan and the information gathered during the step drawdown test, the Aquifer Test Lead will determine the constant discharge flow rate.

13. Before beginning the constant discharge test, the flow control settings may need to be tested. Start the pump, and as quickly as possible adjust the flow rate until it matches the desired quantity. Stop the pump and allow the water level to stabilize.

14. Set the data logger sample rate to the log-cycle, the maximum sampling interval will be determined by the Aquifer Test Lead.

15. Record the time and start the constant discharge test.

16. Record the time, flow meter readings, and depth to water measurements in the field logbook or field activity form as specified by the Aquifer Test Lead or the Aquifer Test Plan. The data may be recorded on computer disks or separate sheets of paper and properly identified when the data logger can be accessed. Continue this until directed to begin the next step of the step drawdown test. See Table B-2 for the recommended monitoring and data recording frequencies.

17. To terminate the constant discharge test and begin the recovery test, at the direction of the Site Aquifer Test Lead, acting in accord with the Aquifer Test Plan, reset the pressure recorders to their start up frequencies (see Table B-1), shut down the pump, and record the time. Continue recording time and depth to water until directed to stop. If a check valve was in place, check the water level in the pump string to determine, and record, if the check valve leaked. Record the time of the end of testing.

Table B-1. List of Accuracies, Monitoring Frequencies, and Relevant Recording Forms.

Step No.	Data Requirements	Recording Form *	EII Value, Frequency, or Accuracy	Comments
1	Equipment Functions Well Dimensions Calibration Due Dates	FLB, FAR FLB, FAR, TFR FLB, FAR, TFR	Verify 0.1 ft Verify	Function test only insures equipment is operable, not the accuracy or reliability.
2	Depth to Water Time	FLB, FAR, TFR FLB, FAR, TFR	0.1 ft 1 min	Water level measurements = Reference Water Level
3	Well Head Configuration Pump Depth Time	FLB, FAR, TFR FLB, FAR, TFR FLB, FAR, TFR	0.1 ft 1.0 ft 1 min	Install pump per ATP or ATL. Use dimensions to draw well head configuration.
4	Transducer Depth Time	FLB, FAR, TFR FLB, FAR, TFR	0.1 ft 1 min	Do not place transducer within one foot of the pump intake.
5 6 7	Baseline Test Time: Start and Stop Depth to Water Data Logger Sample Rate	 FLB, FAR, TFR FLB, FAR, TFR FLB, FAR, TFR	 1 min 0.1 ft	Length of baseline depends on test type. Sample rate set by ATL.
8 9 10 11	Step Drawdown Test Time: Start and Stop Depth to Water Flow Rate Data Logger Sample Rate	 FLB, FAR, TFR FLB, FAR, TFR FLB, FAR, TFR FLB, FAR, TFR	 1 min 0.1 ft 10 percent	Steps should be of equal length; do NOT shut off the pump between steps.
12	Recovery Test Time: Start and Stop Depth to Water Data Logger Sample Rate	 FLB, FAR, TFR FLB, FAR, TFR FLB, FAR, TFR	 1 min 0.1 ft	When pumping stops, the recovery test begins.
13	Set Discharge Rate	FLB, FAR, TFR	10 percent	Run the pump as little as possible.

Step No.	Data Requirements	Recording Form *	EII Value, Frequency, or Accuracy	Comments
14 15 16	Constant Discharge Test Time: Start and Stop Depth to Water Discharge Data Logger Sample Rate	 FLB, FAR, TFR FLB, FAR, TFR FLB, FAR, TFR FLB, FAR, TFR	 1 min 0.1 ft 10 percent	If the flow rate is adjusted before starting, the early time data should be valid.
17	Recovery Test Time: Start and Stop Depth to Water Data Logger Sample Rate	 FLB, FAR, TFR FLB, FAR, TFR FLB, FAR, TFR	 1 min 0.1 ft	Transmit records to field file custodian within 30 days.

* FLB = Field Logbook, FAR = Field Activity Report, TFR = Test Form Required

Table B-2. Recommended Step Test Drawdown, Recovery, Discharge Recording Frequencies.

Data Logger Sampling Rates			
Test Type	Length of Test	Timing Mode	Maximum Interval
Baseline	$\leq$ 8 hrs	Linear	10 min
	$\geq$ 8 hrs	Linear	1 hr (on the hour)
Step Drawdown and Recovery	N/A	Logarithmic	10 min
Constant Discharge and Recovery	$\leq$ 8 hrs	Logarithmic	10 min
	$\geq$ 8 hrs	Logarithmic	100 min

APPENDIX C

K-V ASSOCIATES GEOFLO® GROUNDWATER FLOWMETER SYSTEM METHOD

1.0 DISCUSSION OF METHOD

The K-V Associates, Inc., Geoflo® Groundwater Flowmeter System[1] (the flowmeter) is a heat-perturbation method that is capable of determining groundwater velocity to a lower limit of 0.04 ft/d (0.012 m/d). The method is used in screened wells only, or in wells where well construction does not bias groundwater flow direction. Furthermore, the packer portion (fuzzy packer) of the probe must fit snugly within the well screen in order for the probe to work properly. Without a snug fit, preferential pathways of groundwater flow between the probe and the well screen may cause inaccuracies in measured groundwater velocities. Although an aquifer test plan is not required in order to use the flowmeter, one may be written in order to provide extra detail about flowmeter use on a particular project or series of wells.

Probe construction includes eight thermistors (4 opposing pairs) mounted concentrically around a heat source at the end of the probe. The probe detects the relative difference in heat between the opposing thermistors. During use, the operator signals the heat source to generate a heat pulse which is detected, in turn, by the surrounding thermistors. Under "no flow" conditions, the heat dissipates outward from the source approximately equal in all directions, and the center of the expanding heat ring remains stationary. All thermistors see the same temperature rise with time, and there is no net difference between opposing pairs of thermistors. In the "flow" condition the center of heat propagation is displaced in the direction of flow, proportional to the flow rate of the water. Thermistors located downstream in the flow detect more heat compared to their opposing upstream counterparts.

Thermistor response with time from each of the four thermistor pairs is recorded digitally. Flow direction and rate are calculated by vector analysis which is based on the linear relationship between thermistor response and flow rate.

2.0 EQUIPMENT REQUIREMENTS

The following is a general list of required test equipment used to measure groundwater velocity in the field or to standardize the tool in the laboratory. As these items of equipment are used, various data or characteristics are recorded on the Aquifer Test Information Sheet (form numbers A-6000-959 and -959.1).

1. <u>K-V Associates flowmeter</u>. Record identification number and standardization identification number.

[1] Geoflo is a registered trademark of K-V Associates, Inc., Groundwater Systems, 281 Main St., Falmouth, MA 02540. K-V Associates, Inc., has U.S. and Canadian patents on the "Groundwater Flowmeter System," and European patents are pending.

2. Standardization cell. Record date of last rebuilding. [Rebuilding to occur annually.]

3. Campbell Data Logger. Record serial number.

4. K-V Associates control box. Record serial number.

5. Lap-top computer or equivalent. Record make, model, and serial number.

6. Installation Rods. Record (+ or - 0.5 ft.) on the total length of rods installed in well and any changes. Most rods are in 10 ft. lengths with some shorter sections to allow orienting plate to rest on the top of the casing.

7. Miscellaneous Equipment such as Fuzzy packer, Portable generator (110 Volt, XX Amp.), Orienting plate, and Steel tape (300 ft), compass, plastic tie-wraps, etc.

3.0 PROCEDURE

3.1 Standardizing probes

Each thermistor has a slightly different response to heat. Therefore, each probe must be standardized in order to relate data collected to true groundwater velocity. Furthermore, the standardization procedure must be re-done periodically in order to insure that the tool is still working properly. The schedule for re-standardization is set by the Field Team Leader/Cognizant Engineer or the aquifer test plan. Typically, a particular flowmeter is standardized before a project or series of wells and then rechecked at the completion of the project. As a minimum, the standardization of each tool must be re-checked quarterly (4 times per year) while the tool is still in service. The tool is within tolerances when the following are satisfied:

(1) the correlation coefficient (r) is greater than 0.95, and

(2) when rechecking the flow direction and flow rate in the standardization cell, they are within tolerances specified by the manufacturer.
Standardization is accomplished by running a specific probe in the standardization cell for a minimum of three different flow rates; and then developing a plot of thermistor pair responses versus flow rate. Because thermistor response in mVolts plotted against flow rate is linear, a straight line can be drawn through the plotted points (linear regression). If the equation for a line is as follows:

$$Y = AX + B \qquad (1)$$

where Y = water flow rate,
X = thermistor response in mVolts,
A = constant (slope of line), and
B = constant (Y intercept),

then the constants A and B are specific for a given probe, and can be used to calculate flow rate during field use of that specific probe.

The standardization procedure is as follows:

1. Set up equipment as shown in Figure C-1. (See operator manuals for the flowmeter and Campbell data logger for assistance.) Align flowmeter in cell in the desired direction (+ or - 2.5°). The orientation plate is scribed at 5° increments around its perimeter. Typically, the tool is first aligned with the initial water flow traveling from south to north across the tool and then turned 180° for the secondary run.

2. Select gears for the standardization cell that will allow for a range of flow rates that span the anticipated groundwater flow rates in the field. Table C-1 shows the selection of gears and the associated flow rates. Since there is no soil in the standardization cell, flow rates in the field will be $1/n_e$ times flow rates in the cell (where n_e = effective porosity). For instance, if groundwater flow rate in the field was expected to be about 1.0 ft/d, and n_e expected to be about 0.2 (or 20%), then the equivalent flow rate in the standardization cell would be 1.0/0.2 or 5 ft/d. Gears for the standardization cell would be selected to provide a range around 5 ft/d. Pick one of the gear combinations for the first flow rate.

3. Adjust pistons on standardization cell so that they will not exceed their normal field of movement. One run of the cell takes approximately 15 minutes.

4. Run the motor with pistons in gear (in the primary direction) for approximately 10 minutes to eliminate any slack in the mechanical system.

5. Set up the data acquisition system to accept data by establishing an individual file and setting up the graph term. (See operator's manual for instructions on how to run PC-208). Record time, gears, direction, probe number, and any comments by use of the computer program PC-208. Set up data collection program to accommodate input data (in mVolts) over the range expected during the standardization runs.

6. Initiate heat pulse on control box. Check current load and record number of amps. on the Aquifer Test Information Sheet.

7. After 180 seconds, save data from primary run and stop motor. Record the computer file name for the data on the Aquifer Test Information Sheet.

8. Reverse motor direction and, with motor off, wait for heat to dissipate (about one hour for flow rates greater or equal to 2.0 ft/d and 2 hours for flow rates less than 2.0 ft/d). Thermistor response can be monitored on the computer screen to be sure that thermistor response returns to base level.

9. After heat from primary run has dissipated, run motor for approximately 10 minutes to eliminate any slack in the mechanical system.

10. Set up computer file to collect data again. (See step 5.)

11. Initiate heat pulse on control box. Check current load and record number of amps. on the Aquifer Test Information Sheet.

12. After 180 seconds, save data from secondary run and stop motor. Record the computer file name for the data on the Aquifer Test Information Sheet.

13. Data from primary and secondary runs must be protected from potential loss by copying to provide backup files.

Steps 1 through 12 are repeated for at least two other flow rates. The results are then analyzed to form a standardization curve and calculate constants which may be used subsequently to interpret results of field tests.

3.2 Field Tests

Data collection at a well site is very similar to standardization runs. Instead of placing the tool in a standardization cell, the flowmeter is placed within a fuzzy packer containing glass beads, mounted on the end of installation rods, and then lowered into the screened interval of a well. However, data collection is virtually the same as standardizing the tool.
The flowmeter is oriented by insuring that the tool is aligned properly with the rods, each rod is aligned properly with adjacent rods, and the uppermost rod is aligned properly with the orientation plate. The orientation plate is then aligned to true north with a compass.

The fuzzy packer must be designed to fit the casing in which the probe will be lowered. For most applications, the tool will be lowered into a 4 inch diameter (nominal) stainless steel well with screen the same diameter. The fuzzy packer used for a 4 inch diameter screen must be a compatible for that diameter. When 6 inch diameter wells are tested, the fuzzy packer must be one designed for a six inch screen. A snugly-fitting fuzzy packer will prevent open volumes of water and preferential pathways for flow.

The procedure for testing the groundwater velocity at a given level in the well screen is as follows:

1. Sampling pumps and any other equipment must be removed from the well. Recently developed wells work best for measuring groundwater velocity because the well screen is relatively free of trapped fines.

2. For wells screened in the upper portion of the unconfined aquifer, measure depth to bottom of the well and depth to water. For wells screened in a confined aquifer, measure depth to bottom. Record weather conditions including temperature (+ or - 1° C). Pay special attention to any windy conditions because of the possibility that changing barometric pressure and windy conditions may affect groundwater velocity near the well.

3. Ensure that flowmeter, rods, and cable have decontaminated appropriately after the last time they were used. Attach flowmeter (with fuzzy packer) to lowermost rod and align the north arrow or scribe mark on the tool with the alignment mark on the lowermost rod. [See step 12 for decontamination.] One other individual (besides the one assembling rods)

must confirm the correct alignment before the tool and rod are lowered into the well. Continue to assemble rods, align marks, and lower tool further into the well until the flowmeter is set at the desired position in the well screen. As the rods are installed, insure that coupling set screws are tight on each rod connection. The alignment on each rod coupling must be verified by at least two individuals prior to being lowered into the well (including the middle connection of a 20 ft section of rods). Install orientation plate at the end of uppermost rod and verify the alignment. Insure that cable is not pinched or cut, especially that orientation plate does not cut or pinch cable at top of casing. If it is necessary to cut a notch in the top of the protective casing for the cable pass-through, make sure metal filings do not enter the well and assure that reference marks are unaffected. Use plastic tie-wraps or equivalent to secure cable to rods during installation. It is best if orientation plate rests directly on the top of the well casing. If that is impossible or impractical, then attempt to position orientation plate as close to the top of the casing as possible.

4. Before attempting to run flowmeter, wait at least one hour after flowmeter is installed to allow water level to stabilize. On the Aquifer Test Information Sheet, record date, well I.D., times starting primary run and secondary run (180°).

5. Move heavy metal equipment away from the well (including vehicles) and turn orientation plate so that 0° (true north) is toward true north. Generally, a compass is used for orienting flowmeter. If it is impossible or impractical to move heavy metal objects or vehicles from the well site, then move a few hundred feet to the north of the well (remember to keep away from metal objects) and back-sight with the compass to established the true north direction and orient the flowmeter. Use wooden stake or other object to help sight the direction for orientation.

6. Set up equipment as in Figure C-2 and start generator.

7. Set up computer, control box, and Campbell data logger to initiate a heat pulse and accept data (see step 5 of standardization sequence).

8. When thermistor response has stabilized (i.e., thermistor response is no longer steadily rising or falling), initiate heat pulse on control box. Check current load and record amps. Record data for at least 180 seconds. Save data in computer, and record computer file name on Aquifer Test Information Sheet. Avoid jarring the well-head assembly while data collection is in progress with the flowmeter. Jarring could translate into errors in tool response.

9. Rotate orientation plate 180°, and wait for heat from primary heat pulse to dissipate (about one hour).

10. Repeat step 8.

11. Save data and insure adequate backup of data. Record computer file name on Aquifer Test Information Sheet.

12. Decontaminate flowmeter, rods and cable (portions that went down the well). If the well is known to be contaminated with hazardous or radioactive wastes, if the well is suspected to be in a plume of contaminated groundwater, or if the well cleanliness is unknown, then the fuzzy packer and glass beads must be discarded after each well, and the remainder of the downhole equipment decontaminated per EII 5.4. If the groundwater is known to have no significant contamination (i.e., contaminants below Drinking Water Standards, or in the case of radionuclides, not significantly above background) then the down-hole equipment is to be cleaned as follows: Flush or rinse the flowmeter (with fuzzy packer and glass beads) in distilled water, and wipe the rods and cable with a clean cloth and de-ionized water (or Columbia River raw water) as they are withdrawn from the well. The rods that encounter groundwater shall be sprayed, flushed, or rinsed (both inside and outside) with Columbia River raw water. The decontamination step is very important to prevent well cross-contamination due to flowmeter use.

Table C-1. Gear Selections and Associated Flow Rates for the K-V Associates Flowmeter Standardization Cell.

MOTOR (rpm) x Reduction Ratio x (Drive Gear / Shaft Gear) x Drive Rod x 1440 = inches / day

MOTOR DRIVE (RPM)	REDUCTION BOX (Ratio 1/196)	DRIVE GEAR (No. Gears)	SHAFT GEAR (No. Gears)	DRIVE ROD (inches/rev.)	inches/day	feet/day
11.18	0.005102041	16	24	0.1	5.475918	0.456327
11.18	0.005102041	16	30	0.1	4.380735	0.365061
11.18	0.005102041	16	60	0.1	2.190367	0.182531
11.18	0.005102041	16	120	0.1	1.095184	0.091265
11.18	0.005102041	24	16	0.1	12.32082	1.026735
11.18	0.005102041	24	30	0.1	6.571102	0.547592
11.18	0.005102041	24	60	0.1	3.285551	0.273796
11.18	0.005102041	24	120	0.1	1.642776	0.136898
11.18	0.005102041	30	16	0.1	15.40102	1.283418
11.18	0.005102041	30	24	0.1	10.26735	0.855612
11.18	0.005102041	30	60	0.1	4.106939	0.342245
11.18	0.005102041	30	120	0.1	2.053469	0.171122
11.18	0.005102041	60	16	0.1	30.80204	2.566837
11.18	0.005102041	60	24	0.1	20.53469	1.711224
11.18	0.005102041	60	30	0.1	16.42776	1.36898
11.18	0.005102041	60	120	0.1	4.106939	0.342245
11.18	0.005102041	120	16	0.1	61.60408	5.133673
11.18	0.005102041	120	24	0.1	41.06939	3.422449
11.18	0.005102041	120	30	0.1	32.85551	2.737959
11.18	0.005102041	120	60	0.1	16.42776	1.36898
11.18	1	16	120	0.1	214.656	17.888

Figure C-1. Equipment Set Up for Standardizing K-V Associates Flowmeter.

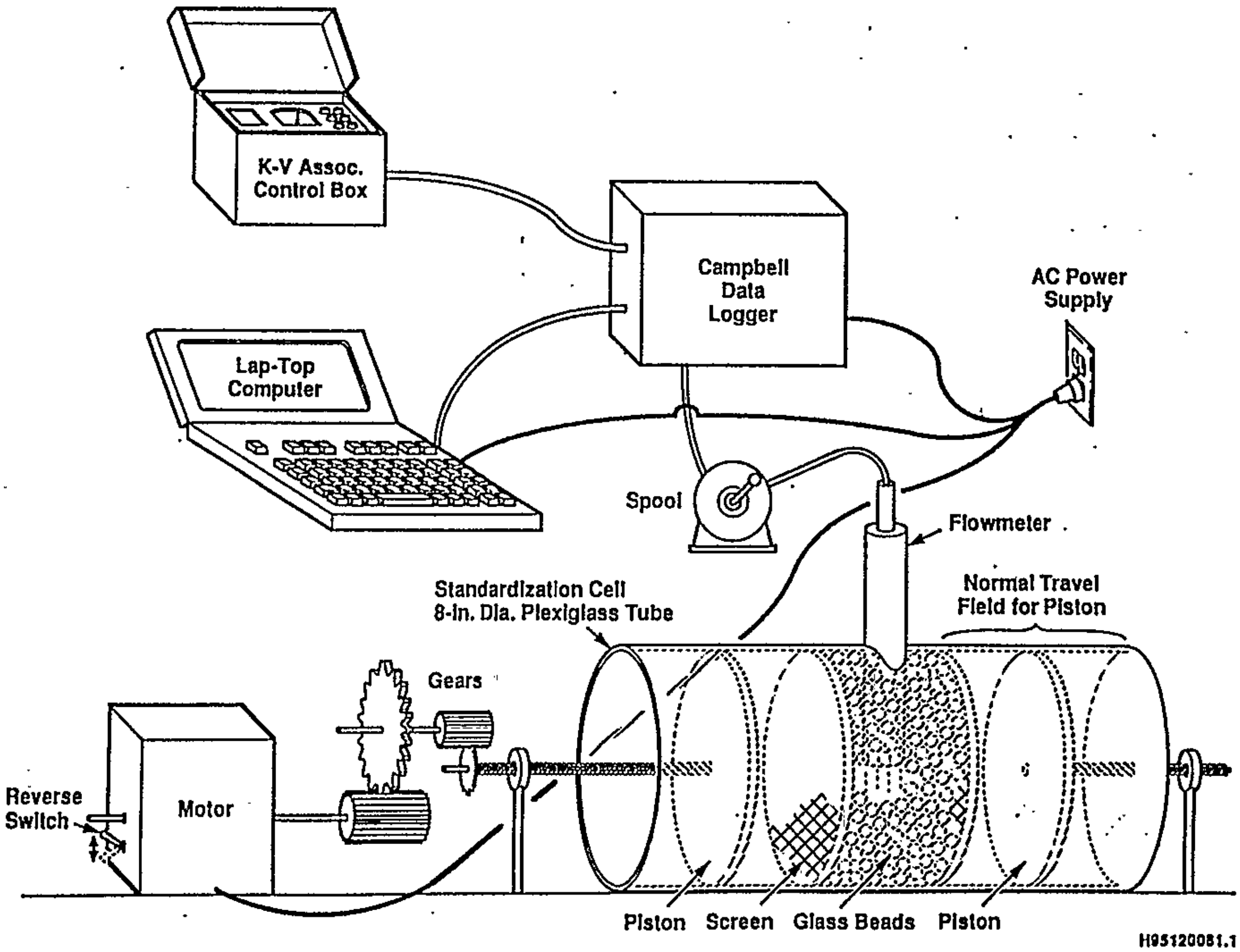
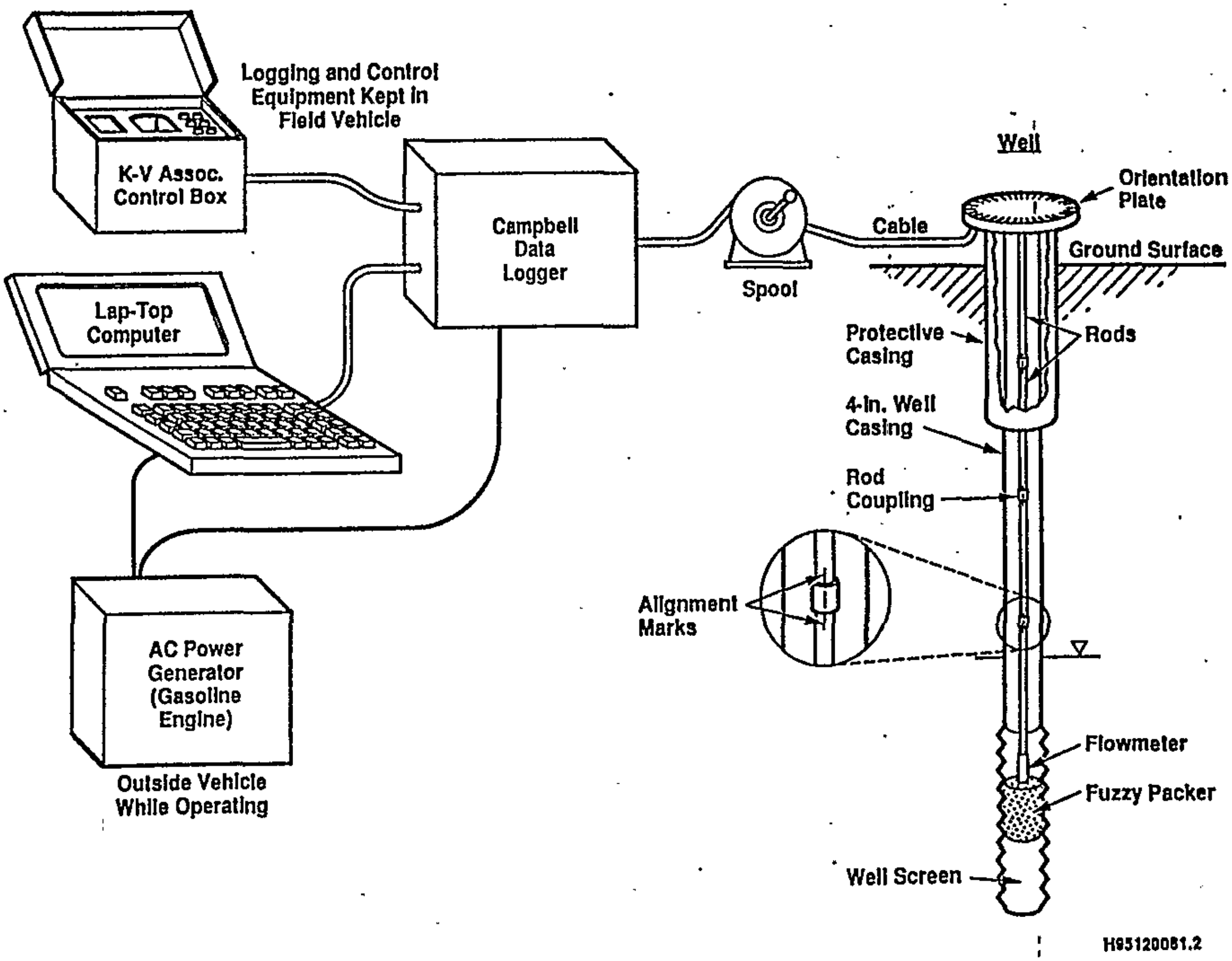


Figure C-2. Equipment Set Up for Field Use of K-V Associates Flowmeter.



1.0 PURPOSE

This Environmental Investigations Instruction (EII) establishes methods for performing and documenting measurements of groundwater levels in monitoring wells.

2.0 SCOPE

This EII applies to measurements of groundwater levels in wells for water level monitoring.

3.0 DEFINITIONS

See the Glossary/Acronyms section of this manual.

4.0 REQUIREMENTS

4.1 Safety Requirements

All groundwater level measurement activities shall be performed in accordance with WHC-CM-4-3 requirements during routine activities or the applicable site health and safety document when groundwater level measurements are performed during hazardous waste site investigations and characterizations.

The Site Safety Officer must monitor health and safety hazards as required by the applicable health and safety documents for hazardous waste site characterization activities.

The *Radiation Control Technician (RCT)* must monitor for radiological contamination as required for work in radiation zones.

4.2 Documentation of Measurements

Groundwater level measurements taken as part of a routine monitoring program shall be documented on an appropriate Groundwater Measurement form. Two Groundwater Measurement forms exist for documenting water level measurements. Routine measurements are to be documented using the Groundwater Monitoring System (GWMS), which automatically generates a Groundwater Measurement report. Data is electronically transmitted to this form. During measurements, if the GWMS fails, data are to be manually documented using the Groundwater Measurement form.

Recording charts from continuous recorders shall identify the well number, the date and time period of record, the device type and serial number, and the names of the persons installing and removing the chart. The chart must also show the water level as measured by a steel tape when the continuous recorder is installed and again when the continuous recorder is removed from the recording device. Charts shall be signed by the field technician and maintained as quality records.

For continuous recorders with memory systems, data shall be transferred to a magnetic disk. The disk shall be printed and labeled with the information required for charts. The disk and hard copy shall be maintained as quality records.

All records shall be processed in accordance with EII 1.6, as specified in Section 6.0 of this EII.

5.0 PROCEDURE

5.1 Preliminary Requirements

5.1.1 Tape calibration

Cognizant Engineer

1. Direct groundwater level measurement activities.
2. Establish the accuracy to which equipment will be calibrated.

Field Technician

3. Ensure that at least one steel tape is calibrated in accordance with manufacturer's instruction and WHC calibration program standards.

   NOTE: Calibrated tapes should <u>only</u> be used to standardize other tapes.

   a. Ensure that a valid calibration sticker and tape identification barcode label are affixed in a visible location.

   b. Return to the standards laboratory any equipment having expired calibration.

Field Technician

   c. Transmit tape calibration records to the File Custodian (FC) in accordance with EII 3.2.

4. Ensure that the tape to be used has been standardized within the last six months.

   a. If not, do not use the tape.

   b. Ensure that a valid standardization sticker and tape identification barcode label are affixed in a visible location.

5.1.2 Tape standardization

Field Technician

1. Use the GWMS to collect tape standardization data.
2. Affix a sticker to the tape, identifying the status and the tape identification number barcode.
3. Perform a comparison in the following manner:

   a. Affix weights having approximately the same weight and volume to both the calibrated tape and the tape(s) to be standardized (the field tapes[s]).

   b. Measure depth to water in a well *that is approximately* the maximum length of the *standardization tape*.

c. If the field tape deviates in length from the calibrated tape by $\leq$ .10 ft, use it to perform water level measurements. Indicate the following by attaching a sticker to the tape.

1) Tape identification number barcode label

2) The word "standardized"

3) Date of standardization

4) Signature of the person(s) performing the standardization

5) The amount of deviation between the calibrated tape and the field tape.

d. If the field tape deviates in length by > .10 ft. and < .25 ft., use it for indication only (e.g., tagging bottom, locating top of water). Indicate the following by attaching a sticker to the tape:

Field Technician

1) "For tagging only"

2) Tape identification number barcode label

3) The signature of the person(s) performing the standardization

4) Date of standardization

5) The amount of deviation between the calibrated tape and the field tape.

e. If the field tape deviates in length by $\geq$ 0.25 ft, it is not acceptable for conducting any measurements. Discard the tape.

4. Maintain a *copy of all tape calibrations and standardization records.*

5.1.3 Cleaning

Field Technician

1. For personnel safety and to prevent cross contamination of wells, clean all measuring devices before each series of measurements and after each well measurement.

a. As a minimum, use potable water, deionized water or Columbia River raw water and a clean towel or clean as directed by the *RCT* and/or the Field Team Leader (FTL).

b. Clean the portion of the measuring device(s) which come in contact with the water plus approximately 3 feet.

c. Indicate on the Groundwater Measurement form whether or not cleaning was performed using potable water.

d. If an alternative method was used, indicate which method in the space provided on the Groundwater Measurement form.

5.1.4 Reference point

Field Technician

1. Establish a reference point at the top of the well casing.

   a. Measure to the nearest 0.01 ft.

   b. *Ensure* that the reference point is clearly and permanently marked.

   c. Survey to establish the elevation with reference to a Vertical Control point in use at the Hanford Site.

   d. *Ensure* that the current elevation is recorded on the Groundwater Measurement form.

5.1.5 Measurement point

Field Technician

1. Establish a measurement point near the top of the well head. This point could be on a well seal, *the top rim of a casing*, pump plate or similar device.

2. *Consistently* measure depth to water from this point.

3. Describe the measurement point in the space provided on the Groundwater Measurement form.

5.2 Groundwater Level Measurement Methods

5.2.1 Weighted measuring tape

Field Technician

1. Collect and document data obtained using a weighted steel measuring tape and either using the GWMS or manually as required. If a well is unable to be measured due to extenuating circumstances, record a description of the problem in the comment section of the handheld computer unit (HCU) or Groundwater Measurement form.

   a. The GWMS is the primary method for collecting water-level data. This system partially automates the collection of groundwater levels using barcode technology, HCUs, and a qualified database to import the field data from the HCUs. To facilitate this process, a barcode label with a unique identifier is attached to each well being measured on a periodic basis. Data collected by the GWMS is electronically transmitted to the *Data Management organization* for input into the HEIS for access. For detailed instructions pertaining to the use of the GWMS, refer to WHC-SD-EN-UM-004.

Field Technician

b. If the GWMS cannot be used, collected data can be manually recorded on the Groundwater Measurement form. This form serves as a backup system to the GWMS and is used for making nonroutine water level measurements.

2. Use the weighted tape as follows (all references to a form pertain to the Groundwater Measurement form used for manually recording water level data).

   a. Determine the difference between the reference point (RP) and measurement point (MP) using a carpenter's level and steel scale capable of measuring 0.01 ft gradations, or using measured documented dimensions of the well appurtenances (e.g., well seal, pump plate). If survey data exist for both the MP and the RP, these values can be subtracted to obtain the "MP-RP" value. Record the difference in the "MP-RP" column of the form or input the value when prompted by the HCU (select default if appropriate).

   b. Chalk the lower 1 ft segment of the tape that extends below the zero point of the tape by drawing it across carpenter's chalk.

   c. Lower the tape into the well until the water surface is penetrated and a marked increment on the tape coincides with the MP.

   d. Note the tape reading at the measurement point.

   e. Withdraw the tape without letting the tape go deeper into the well than the hold point. Note the reading at the demarcation between the dry and wetted portions of the tape. This reading indicates the length of the remaining dry portion of the chalked portion.

   f. Add the length of the dry portion below the zero mark to the tape reading taken at the measurement point (step d, above). This quantity is the depth from the measurement point to the groundwater level and is either input into the HCU barcode reader or manually recorded on the form under the column headed "Depth to Water From MP."

Field Technician

   g. The time is automatically input into the GWMS HCU. If manually performing measurement, record the time the measurement is made on the form under the column headed "Time."

   h. During manual data collection, obtain the adjusted depth to water by subtracting the MP-RP reading (step a, above) from the depth to water from MP reading (step f, above). This quantity is the depth from the reference point to the groundwater level and is recorded on the form under the column headed "Adjusted Depth to Water From RP." This step is done automatically if the GWMS is used and no action is required from the field technician performing measurements.

i. When performing routine groundwater level monitoring, take at least two consistent measurements to ensure the adequacy and accuracy of the measurement. The measurements shall be within .02 ft. of each other.

j. Transfer of data collected by the HCU to the GWMS supervisor station shall be completed at the end of each shift.

5.2.2 Electric sounder

The electric sounder will be used for indication purposes only, and measurements will not be acceptable as quality data.

Field Technician

1. Use the electric sounder following the steps given in section 5.2.1, except that steps a through d below replace steps b through f in Section 5.2.1.

   a. Check the operation of the equipment by inserting the probe or contact ends in water to ensure that contact is clearly indicated on the meter.

   b. Lower the probe or exposed contact ends of the tape into the well.

   c. When the meter registers contact with water, record the tape graduation reading at the measurement point. This reading is the depth from the measurement point to the water level.

   d. Take at least two consecutive, consistent measurements to ensure the adequacy and accuracy of the measurement when performing groundwater level monitoring unless conditions warrant rapid measurement of changing water levels or as indicated by the Cognizant Engineer.

5.2.3 Continuous recording device

The continuous recording device is used to record changes in the water level over a continuous period of time.

Field Technician

1. Check operation of the equipment in accordance with manufacturer's instructions.

2. For float-balance type devices, set the float in accordance with the manufacturer's instructions. The float should be of a diameter large enough to minimize friction between the float cable and the well walls. For pressure-transducer type devices, set the transducer as required by the manufacturer's instructions.

3. Fit the recorder with a locking weatherproof casing to protect the equipment from damage and weather.

4. Set the recorder in accordance with the manufacturer's instructions and secure the protective casing.

5. Check the recorder periodically to ensure that a malfunction has not occurred.

    a. Perform operational checks, as a minimum, each time the recording chart is changed, or as recommended by the cognizant engineer.

    b. Checks shall include a comparison of the recorded depth with a measurement made with a weighted, steel tape.

    c. Record the measured depth, the date, time of measurement and the name of the person making the measurement on the recorder chart; each chart should indicate, as a minimum, when the chart is emplaced and when it is removed.

    d. Also record the measured depth on the Groundwater Measurement form.

    e. Check pressure-transducer recording at a frequency indicated by the Cognizant Engineer.

5.3 Documentation

Identify recording charts, magnetic disks and hard copies of the data from continuous recording devices with the well number, date and time of chart emplacement and removal (or data removal in the case of a pressure-transducer), and the device type and serial number.

5.3.1 Recording data manually

Field Technician

1. When manually recording measurement data, enter the following on the Groundwater Measurement form:

- *measuring device type*
- *device ID number*
- *time of measurement*
- *depth to water from measuring point (feet)*
- *adjusted depth to water from reference point (feet)*
- *cleaning method and comments.*

2. Sign the form, then forward on to the individual authorized to review, sign and transmit the form to Groundwater Management.

5.3.2 GWMS data recording

Documentation of data by the GWMS is recorded automatically on a Groundwater Measurement Report. Data collected using an HCU is electronically transmitted to this form. The form must be signed by the individual collecting the data. An authorized person must review and sign the form prior to transmittal to Groundwater Management.

6.0 RECORDS

Records are processed and dispositioned in accordance with the following table:

Name, Filing Unit Title or Description	Record Type*	Retention Period	Disposal Authority	Cut-off and Retirement Instructions
Groundwater Measurement form/ Groundwater Measurement Report	QA	TBD	DRS 1.8f	Transmit completed form(s) to the FC for review. The FC then transmits the form(s) to Groundwater Management (GM) within five working days. GM retains a reference copy, sends a copy to Well Services, and the transmits the original to storage in accordance with WHC-CM-3-5, Section 5. The FC includes a copy in the water level measurement files.
Calibration and Standardization Records	*QA*	*TBD*	*TBD*	*Upon completion, transmit to FC. FC makes a copy and forwards the record to storage.*
Charts and magnetic disks	QA	TBD	TBD	GM transmits to IRM permanent storage in accordance with approved RIDS.

* QA = Quality Assurance; TBD = To be determined

7.0 DESIGNATED REVIEWING ORGANIZATION

The organization designated to review changes to this document is listed below. Comments from other organizations are welcome; however, such courtesy comments are dispositioned at the option of the originating organization.

Designated Reviewers	CMPOC
Hanford Technical Services, process owner	*PSS/HTS*

8.0 FORM

Groundwater Measurement Form (A-6000-458)

9.0 BIBLIOGRAPHY

WHC-CM-4-3, *Industrial Safety Manual.*

WHC-SD-EN-UM-004, *User Manual for the Groundwater Monitoring System.*

1.0 PURPOSE

The purpose of this environmental investigations instruction (EII) is to implement the requirements established in the "Strategy for Handling and Disposing of Purgewater at the Hanford Site, Washington" (Strategy Document) and procedures found in Westinghouse Hanford Company (WHC) manuals.

2.0 SCOPE

This EII applies to the management of purgewater that is generated from the development, remediation, maintenance, aquifer testing, and sampling of the Hanford Site groundwater monitoring wells collected by WHC or contractors performing work for WHC. The application covers activities from the time of purgewater generation to its *discharge to* either a storage facility or the soil column.

3.0 DEFINITIONS

See the Glossary/Acronym section in this manual.

4.0 REQUIREMENTS

4.1 Safety

1. Personnel performing the varied activities in regard to purgewater collection, handling, transportation, and storage shall comply with the specific site safety requirements.

2. Purgewater containment vehicles operated in radiological areas and that have fixed contamination within the cargo area exceeding the values of Table 2-2, *in Chapter 2 of the Hanford Site Radiological Control Manual, HSRCM-1*, shall have "Regulated" placards permanently affixed to the front, back, and both sides of the vehicles.

3. General Precautions for handling of all purgewater.

    a) Do not drink purgewater.

    b) Purgewater spilled directly or indirectly on the skin, will in general, not be an immediate health hazard. However, if purgewater comes in contact with the skin, review the site-specific safety documents and notify the person in charge (PIC) at the site to determine if a survey should be conducted by the local Health Physics Technician (HPT).

    c) Wear rubber gloves while handling hoses or other equipment when loading and unloading tank trucks.

    d) If purgewater splashes in the eyes or is swallowed accidentally, report to the nearest first aid station and HP office for examination and treatment.

4.2 Purgewater Spill

1. WHC employees shall immediately report any accidental spill of purgewater, exceeding 113 liters (30 gal.), to their management.

2. Management shall implement response actions, investigate and categorize the event per WHC-CM-1-5, Section 7.1.

   NOTE: When investigating and categorizing a purgewater spill, consideration should be given to Para. 3.6.2 of the Strategy Document which states that purgewater management at Hanford is not subject to the groundwater listed waste designation procedures as set forth in WAC Chapter 173-303.

4.3 Training

1. Support personnel shall receive training as mandated by WHC-CM-7-7, EII 1.1, "Hazardous Waste Site Entry Requirements".

2. Newly hired purgewater truck drivers shall receive a documented briefing on this procedure which shall include a hazardous material orientation for purgewater transportation.

4.4 Purgewater Collection

1. Purgewater from WHC monitored wells shall be appropriately managed in accordance with health and environmental-based purgewater collection criteria factored into the "Purgewater Strategy Implementation List" ("No Dump" list) of wells.

2. Purgewater extracted from wells not listed, or listed as "Contain Purge Water", in Item 1 above, shall be collected and stored unless a documented purgewater determination has been performed to provide evidence that existing contaminants are found in quantities less than the collection criteria.

3. Purgewater containing constituents in concentrations lower than the collection criteria can be discharged to the soil at or in the immediate vicinity [approximately 15 meters (50 ft.)] of the well head when such wells do not monitor;

   a. designated RCRA Solid Waste Management Units (SWMUs),
   b. burial grounds,
   c. active/inactive liquid effluent disposal sites,
   d. known surface or subsurface soil contamination areas.

   Purgewater from wells in the areas cited above shall be contained.

4. Purgewater required to be contained shall be stored in the 600 Area Purgewater Storage and Treatment Facility (storage facility).

5.0 INTERFACES

5.1 Westinghouse Hanford Company (WHC)

1. Generates purgewater from sampling groundwater monitoring wells, well development, aquifer testing, well maintenance and remediation.

2. Provides analytical data input from purgewater collection determinations per WHC-CM-7-8, Vol. 4, Section 6.1, "Purgewater Collection Determination".

3. Manages the purgewater storage facility for receipt of purgewater generated by all site contractors in accordance with Tank Farm Plant Operating Procedure (POP), TO-040-010, "Perform Operations/ Surveillance - Purgewater Storage Facility".

5.2 ICF Kaiser Hanford

1. Provides WHC, its contractors, and contractors supporting WHC work, with purgewater collection and transportation services from the well site to the storage facility.

5.3 Pacific Northwest Laboratories (PNL)

1. Generates purgewater from sampling groundwater monitoring wells, well development, aquifer testing, well maintenance and remediation.

2. Provides controlled distribution of the "Purgewater Strategy Implementation List" ("No Dump" list). Persons with questions regarding the "No Dump" list may call 372-0069.

3. Utilizes analytical data to revise the "No Dump" list.

5.4 Bechtel Hanford Incorporated (BHI)

1. Generates purgewater from sampling groundwater monitoring wells, well development, and aquifer testing, as described in the Environmental Restoration Contract (ERC).

2. Maintains and updates the Purge Water Activities Database.

6.0 PROCEDURE

6.1 Planning

Site Management shall:

1. Use the "No Dump" list to determine if purgewater from the assigned groundwater well activity is to be contained.

- If the well number is listed and is designated for containment, an update of the containment determination, may be requested from WHC, *Hanford* Technical Services.

- If the well number is not listed, request a purgewater containment determination from WHC, *Hanford* Technical Services.

The designated person-in-charge at the site shall:

2. Use the safest (ALARA) feasible method for collecting and transferring purgewater to the tank truck.

3. Examine pumps, hoses, buckets, couplings, and other equipment to assure that leaks and spills of purgewater will be avoided when transferred to the tank truck.

4. Interface with ICF Kaiser Hanford, Transportation & Waste Handling, to schedule purgewater pick-up. Contact ICF Kaiser Hanford schedulers on 376-0971 for information.

5. Be knowledgeable of the historical and most recent analytical results from the source of purgewater extraction to assure spills and/or contact with the skin will be appropriately addressed.

Management/Supervision of purgewater truck drivers shall:

6. Arrange for orientation and training of the truck drivers in handling collected purgewater.

6.2 Purgewater Collection and Transport

The tank truck driver shall perform the following:

1. Park purgewater trucks and other vehicles downwind of groundwater sampling operations.

2. Transfer purgewater or raw water to the tank truck in a safe manner.

3. Record the volume (in liters or gallons, however, indicate which units are used) of purgewater or raw water collected on the Well Purgewater Transport Log (WPTL), BC-6000-453, and provide the total volume if numerous sites were visited prior to disposal.

4. Transport collected purgewater to the storage facility.

5. Notify East Tank Farms Operations (ETFO) two (2) hours prior to unloading collected purgewater at the storage facility. Call the Shift Office on 373-1600, 373-2689, or radio station 22 and the Tank Farm Surveillance Office at 373-2929.

6. Provide the ETFO operator, at the storage facility, with the original WPTL.

6.3 *Discharge* of Purgewater at the Storage Facility

The ETFO operator provides operations and surveillance services per POP TO-040-010.

6.4 Records Handling and Purgewater Database Tracking

The ETFO operator shall:

1. Verify the volume of all water (purgewater and raw water) inflow to the storage facility and document by signing and dating the WPTL.

2. Forward a copy of the WPTL to the Purge Water Activity Database operator.

3. Send the original of the WPTL to the ETFO Project Files.

The database operator shall:

4. Update the database upon receipt of the WPTL.

5. Maintain an electronic backup of the database. Persons with questions regarding the database may call 376-8596.

Records shall be retained as described in the following table. Responsibility for retention is as follows:

Well Purge Water Transport Log, WHC, ETFO
Purge Water Activity Database, BHI

Name Filing Unit Title or Description	Record Type*	Retention Period	Disposal Authority	Cut-off and Retirement Instructions
Purge Water Activity Database. Registration #11357	R	TBD	TBD	Maintain as operational until no longer needed.
Well Purge Water Transport Log (BC-6000-453)	R	TBD	TBD	Transmit to File Custodian (FC) to retain in the Project File.

7.0 DESIGNATED REVIEWING ORGANIZATIONS

The organizations designated to review changes to this document are listed below. Comments from other reviewers are welcome, but are resolved at the originating organization's option.

Designated Reviewing Organizations	CMPOC
Hanford Technical Services, author	PSS/HTS
Tank Farms Transition Projects, Environmental Engineering	TFTP/EE

8.0 FORM

Well Purge Water Transport Log (BC-6000-453, Jetform).

9.0 REFERENCES

HSRCM-1, *Hanford Site Radiological Control Manual.*

WAC 173-303, "Dangerous Waste Regulations."

WHC-MR-0039, *Strategy for Handling and Disposing of Purgewater at the Hanford Site, Washington,"* July 1990.

WHC-CM-1-5, *Standard Operating Practices*, Section 7.1, "Reporting Occurrences and Processing Operations Information."

WHC-CM-7-5, *Environmental Compliance*, Section 5.0, "Records, Reporting, and Response Activities."

WHC-CM-7-7, *Environmental Investigations and Site Characterization Manual*, EII 1.1, "Hazardous Waste Site Entry Requirements."

WHC-CM-7-8, *Environmental Engineering and Geotechnology Procedures*, Volume 4, Section 6.1, "Purgewater Collection Determination."

Tank Farm Plant Operating Procedure (POP), TO-040-010, *Perform Operations/Surveillance - Purgewater Storage Facility.*

TITLE:

WELL DEVELOPMENT ACTIVITIES

Approved by

K. R. Fecht, Manager
Geosciences

1.0 PURPOSE

This Environmental Investigations Instruction (EII) *establishes the information to be recorded and methods to follow for well development of newly drilled or restored wells on the Hanford Site.*

2.0 SCOPE

This EII applies to personnel who are responsible for (or assigned to) recording various activities and collecting information during the well development operations that are performed by or for Westinghouse Hanford Company (WHC).

3.0 DEFINITION

See WHC-CM-7-7 Glossary/Acronyms.

4.0 RESPONSIBILITIES

4.1 COGNIZANT ENGINEER/FIELD TEAM LEADER

The Cognizant Engineer (RCRA)/*Field Team Leader* (CERCLA) is responsible for:

1. Coordinating the field activities associated with the collection of information required by this EII.

2. *Ensuring* disposal of the well development water in accordance with EII 10.3.

4.2 WELL DEVELOPER

The well developer is the WHC organization(s) and/or contractor *with geotechnical responsibility for* the well development activities and is responsible for:

1. Following the manufacturer's recommended procedure in field calibrations and operations when using equipment to determine completion of well development.

2. *Documenting well development activities in accordance with this EII, including the identification of the well development method being used.*

5.0 REQUIREMENTS

5.1 DEVELOPMENT COMPLETION

1. The well developer shall determine the turbidity of the development water using a nephelometric turbidimeter in accordance with manufacturer's recommended procedure.

2. Well development shall be carried out until a final water turbidity of $\leq$ 5 *Nephelometric Turbidity* (NTU) is achieved *or until 1,200 gallons of water have been removed from the well.*

3. The *Cognizant Engineer/Field Team Leader* (CE/*FTL)* shall be *notified* if water turbidity remains greater than 5 NTU after *an estimated* 1,200 gallons of water have been removed. *The CE/FTL will evaluate the development data (flow rate, current turbidity, and turbidity verses time) and determine probable pumping time to reach the 5 NTU recommended value. The CE/FTL will consider the possible contaminates and the effect of > 5 NTU on the analysis and decide whether to continue pumping until 5 NTU value is met or to continue pumping to another check point (i.e., 2,000 gallons) or stop pumping.*

5.2 WATER LEVEL MEASUREMENTS

Water level measurements shall be in accordance with EII 10.2.

6.0 PROCEDURE

Various methods can be used for well development; these *typically* include bailing, surge block, airlift, and mechanical pumping. The Well Construction Summary Report (A-6000-436) *can* be used as a reference of the basic design completion of each well. The method(s) for well development shall be determined by the CE/*FTL.*

6.1 INFORMATION COLLECTION

If information is collected by means of a data logger or if the data collected will not fit on the form being used, the data may be properly identified and attached to forms *required by* this EII.

Place other significant information that pertains to well development in the comment section of the Well Development Form.

6.2 BAILING

Bailing is normally the first step in the well development process to remove the drill cuttings and *sediment* from the well. Steps 1 through 5 *below*, shall be recorded on the Well Development Form, Figure 1, when performing this operation.

1. The water level and time of the measurement prior to the start of the bailing operation.

2. The volume of the bailer that is used in the bailing operation.

3. The number of bails used to clean the well.

4. A description of the water at the end of the bailing stating the relative amount of the sediment in the water. This description shall be general in nature, such as clear, slightly sandy, extremely sandy, etc. Bailing is considered the first step in a process to develop the well. Bailing is not intended to achieve a final NTU reading.

5. The water level and time of measurement immediately after the bailing has stopped.

6. Sketch an equipment configuration and well head diagram on the Equipment Configuration and Well Head Diagram form, Figure 2, *also record a* description of the equipment configuration on this form.

6.3 MECHANICAL PUMPING

Mechanical pumping *is* the most common development method used on the Hanford Site. This method usually uses either a turbine pump or a submersible electric pump to remove water from the well. The following information will be recorded during the development operations *when* using a mechanical pump. Steps 1 through 4 *below*, shall be recorded on the Well Development Form.

1. The depth at which the pump intake is set.

2. The pumping technique that is used such as constant discharge.

3. The start and stop time of the pump, the flow rate and accumulated gallons discharged during pumping.

4. The turbidity of the water in NTU prior to the termination of development. These measurements will be obtained at times indicated by the CE/*FTL* and from the final water sample that is collected prior to the termination of development.

5. Sketch an equipment configuration and well head diagram on the Equipment Configuration and Well Head Diagram form, Figure 2, *also record a* description of the equipment configuration on this form.

6. If required by the CE/*FTL, conduct drawdown and/or recovery testing of the aquifer by recording water level verses time* on the Drawdown/Recovery Form, Figure 3.

6.4 SURGE BLOCK

Developing a well using the surge block technique requires the use of a block 1 to 2 inches smaller in diameter than the inside diameter of the well, with rubber discs the same diameter of the inside casing. This block is attached to the drill stem. On the "up" stroke of the surge block, fine sediments will be drawn into the well, and on the "down" stroke, sand bridging will be broken down. Steps 1 through 7 *below* shall be recorded on the Well Development Form.

1. The type and dimensions of the surge block.

2. The total depth (TD) to the bottom of the well (tagging the bottom) before the surging operation begins.

3. The stroke length, which is the distance in feet that the surge block moves from the top of the stroke to the bottom of the stroke.

4. The stroke frequency, which is the amount of time in seconds between stroke cycles.

5. The surge interval, which is the range of depth in feet from the reference point that the surging operation is meant to affect.

6. The surge time, which is the amount of time that the surging action is being performed.

7. The amount of sediment that enters the well at each interval, *is determined* by recording a TD measurement to the bottom of the well (tagging the bottom) after surging and calculating the difference in depth to the bottom before and after surging.

8. Sketch an equipment configuration and well head diagram on the Equipment Configuration and Well Head Diagram form, Figure 2, *also record a* description of the equipment configuration on this form.

6.5 AIRLIFT

The airlift method for developing a well requires the use of filtered compressed gas or air that is fed to the eductor pipe by way of the air line (usually 1 foot above the bottom of the eductor pipe). The eductor pipe usually is set with a minimum of 30 percent submergence. Steps 1 through 3 *below* shall be recorded on the Well Development Form.

1. The depth of the eductor pipe *and* the start and stop time of the airlift.

2. The flow rate of the discharge and the accumulated flow over the length of the development.

3. The turbidity of the water in NTU prior to the termination of development. These measurements will be obtained at times indicated by the CE/FTL and from the final water sample that is collected prior to the termination of development.

4. Sketch an equipment configuration and well head diagram on the Equipment Configuration and Well Head Diagram form, Figure 2, *also record* a description of the equipment configuration on this form.

5. If required by the CE/*FTL*, record water level measurements in the well during the pumping and/or recovery of the aquifer on the Drawdown/Recovery Form, Figure 3.

6.6 DRAWDOWN/RECOVERY

The header information requested on the Drawdown/Recovery Form, Figure 3, is self explanatory and shall be filled out by the recorder prior to the start of data recording. The column information requested is explained below:

1. Under the main heading of TIME the following information shall be recorded:

   Date. Date that data is being recorded.
   Time. Time that data is being recorded.

2. Under the main heading of WATER LEVEL the following information shall be recorded:

   Reading. Water level information taken from a transducer system if installed by the well developer.

   Water Level. Water level information (in feet) taken in accordance with EII 10.2 by the well developer using a steel tape or electric tape, if a transducer has not been installed by the well developer.

3. Under the main heading of DISCHARGE the following information shall be recorded:

   Reading. Reading taken from the water flow meter installed in the discharge pipe at interval indicated by the CE/*FTL*. The initial reading shall be indicated at the pump start time.

4. The recorder shall sign at the bottom of the Drawdown/Recovery Form.

6.7 RECORDS

Record retention is in accordance with Table 1.

7.0 REFERENCES

WHC-CM-7-7, Environmental Investigations and Site Characterization Manual.
EII 10.2, "Measurement of Groundwater Levels."
EII 10.3, "Purgewater Management."

Table 1. Record Requirements.

NAME Filing Unit Title or Description	RECORD TYPE*	RETENTION PERIOD	DISPOSAL AUTHORITY	CUT-OFF AND RETIREMENT INSTRUCTIONS
Well Development Form (A-6000-393)	QA	TBD	TBD	Transmit to file custodian (FC) upon completion for transmittal to Records Holding Area (RHA) in accordance with approved RIDS.
Equipment Configuration and Well Head Diagram (A-6000-417)	QA	TBD	TBD	Transmit to FC upon completion for transmittal to RHA in accordance with approved RIDS.
Drawdown/Recovery (A-6000-402)	QA	TBD	TBD	Transmit to FC upon completion for transmittal to RHA in accordance with approved RIDS.

* QA = Quality Assurance; TBD = To be determined

Figure 1. Well Development Form. (A-6000-393)

WELL DEVELOPMENT FORM Page ______ of ______

Well Designation ______________ Well Depth ______________

Screened Interval ______________ Date Well Development is Performed ______________

BAILING

Water Level Prior to Bailing ______________ Time of Measurement ______________

Volume of Bailer ________ Number of Bails Removed ________ Gallons ________

Summary Description of Water Removed ______________

Water Level After Bailing ______________ Time of Measurement ______________

SURGE BLOCK

Type of Surge Block ______________ Dimension of Surge Block ______________

TD BEFORE	STROKE LENGTH	STROKE FREQUENCY	SURGE INTERVAL	SURGE TIME	TD AFTER	TD DIFFERENCE

AIRLIFT

Depth of Eductor Pipe ______________ Airlift Start Time ______________

Flow Rate ________ Accumulated Flow ________ Airlift Stop Time ________

Turbidity ______, ______, ______, ______, ______, ______, ______, ______
______, ______, ______, ______, ______, ______, ______, ______

MECHANICAL PUMPING

Pumping Technique ________ Pump Depth ________ Pump Start Time ________

Flow Rate ________ Accumulated Flow ________ Pump Stop Time ________

Turbidity ______, ______, ______, ______, ______, ______, ______, ______
______, ______, ______, ______, ______, ______, ______, ______

Comments ______________

Signature of Recorder ______________ Date ______________
Sign and Print Name

A-6000-393 (03/90)

Figure 2. Equipment Configuration and Well Head Diagram. (A-6000-417)

EQUIPMENT CONFIGURATION AND WELL HEAD DIAGRAM Page ____ of ____

Well Designation ______________________ Depth ______________________

Equipment Configuration

Item	Description	Diagram

Well Head

Comments	Diagram

Signature of Recorder ______________________ Date ____________

A-6000-417 (08/89)

Figure 3. Drawdown/Recovery. (A-6000-402)

DRAWDOWN/RECOVERY

Page _____ of _____

Well Designation ____________________ Date __________

Well Depth ____________________ Screened Interval ____________________

Pumping Method ____________________

Equipment Used to Measure Water Level __________ S. N. __________ Calibration Due __________

Equipment Used to Measure Flow __________ S. N. __________ Calibration Due __________

Measuring Point ____________________ Pump Start Time __________ Pump Stop Time __________

Time		Water Level		Discharge
Date	Time	Reading Unit:	Water Level Unit:	Reading Unit:

Signature of Recorder ______________________________ Date __________
Sign and Print Name

A-6000-402 (03/90)

INSTRUCTION CHANGE AUTHORIZATION

ICA No. 092

Instruction (EII) No.	Rev. No.	
EII 11.1, Geophysical Logging	2	Page 1 of 1

Description of Change

Impact Level Q

In lieu of using the Logging Specifications sheet, Figure B-1 and Logging Data sheet, figure B-2, a NaI Spectral Gamma-Ray Borehole Survey Log header will be substituted.

[] One Time [X] Permanent

Justification

The revised form contains the necessary information needed for validation of the borehole completion package.

The information previously contained on the old forms is available on optical disk if needed.

Approvals: (Type/Sign Name and Date)

R. K. Price RK Price	23MAR94	J. W. Fassett J. W. Fassett	3/23/94
ICA Author	Date	ICA Author's Manager	Date
K. R. Fecht KR Fecht	3/23/94	W. R. Thackaberry WR Thackaberry	3.23.94
EII Author's Manager	Date	Quality Assurance (If Required)	Date
		N/R	
		Safety (If Required)	Date

A-6000-370 (12/91) (EF) WEF158

Westinghouse Hanford Company
NaI Spectral Gamma-Ray Borehole Survey Log Header

Project Information

Borehole ____________

Project ____________

Borehole Environment Information

Borehole liquid depth _____ (ft) from zero (0.0) depth reference of log

Casing size (inch)	Casing thickness (inch)	Top depth (feet)	Base depth (feet)

NaI Passive Spectral Gamma Survey Information

Logging Engineer(s) ____________ ____________
Log depth reference at zero (0.0) depth is ____________
Depth return error recorded at zero depth reference.
☐ Pre log energy calibration spectra recorded with field verifier.
☐ Logging Equipment was cleaned as described in WHC-CM-7-7 EII 11.1 Section 5.4 Signed ____________ Date ________
Detector Type: ____________ Detector ID: ________
Calibration Date: ____________
Notes: ____________

Log Date	Archive File Names	Log Mode	Speed ft/m	Depth interval (ft) Top	Base	Incr	Return Error (inch)

Fixed: Constant Winch Speed

1.0 PURPOSE

This Environmental Investigations Instruction (EII) provides the minimum requirements for obtaining borehole geophysical logging data for environmental investigation and site characterization.

2.0 SCOPE

This EII describes the minimum technical requirements for obtaining geophysical logging data. This procedure applies to WHC or its contracted personnel when included in the contract documents.

3.0 DEFINITIONS

See the Glossary/Acronyms Section of this manual.

4.0 RESPONSIBILITIES

4.1 Logging Geophysicist

1. Oversee logging projects, and interface with field team leaders and project scientists/engineers.

2. Review draft remedial investigation plans or other plans involving subsurface investigations, and ensure that logging requirements are included in work plans or contract documents.

3. Prepare logging requirements for inclusion in contract documents (at a minimum, include the requirements of Section 5.2.4 of this EII).

4. Review this EII for applicability to new logging methods as they become available, and implement changes/revisions as required.

5. Prepare new logging procedures for review and approval as new methods become available.

4.2 Logging Technician

1. Maintain and supply the logging equipment in a state of readiness.

2. Monitor equipment performance, and take immediate measures to correct problems.

3. Annually update Radiation Work Permits (RWP), safety documentation, and training and reading requirements.

*** This EII has been totally rewritten, therefore, no revision bars were used to denote changes.**

4. Stay apprised of changes in access to wells throughout the Hanford Site.

5. Maintain training to the level of Hazardous Waste Site Worker.

6. Ensure that logging and records disposition are performed in accordance with this EII.

5.0 REQUIREMENTS

5.1 Qualifications

The logging geophysicist and logging technician must demonstrate training and qualification to the satisfaction of the cognizant manager. Qualification of personnel shall be documented in accordance with EII 1.7.

5.2 Contract Documents

1. When contracted logging is required for characterization work involving wells or boreholes, the logging geophysicist prepares the logging requirements to be included in or attached to the contract document.

2. The contractor must provide documentation of (and the cognizant manager of Geophysics' Investigations must approve) logging technician training, expertise, and experience.

3. The contractor shall submit logging procedures to the logging geophysicist for approval.

4. The work order/statement of work (SOW) shall be delivered to the contractor two weeks prior to logging and shall contain at least the following requirements:

   a. Personnel qualifications and training.

   b. Instrumentation calibration methods.

   c. Preparation and submittal of logging procedures for WHC approval prior to the start of work.

   d. Detailed special logging requirements, when applicable.

   e. Requirements for records maintenance and turnover to WHC.

   f. List of deliverables, including number of wells and type of data (hardcopy/digital).

5.3 Safety

1. All geophysical logging conducted at active characterization or well construction sites shall comply with applicable site safety plans (e.g., HWOPs) and RWPs.

2. Logging conducted at remote work sites shall be conducted in compliance with the controls outlined in the Hanford Job Hazard Analysis Checklist specific for sitewide geophysical logging.
3. Safety equipment may include steel-toed shoes/boots, hard hat, blue coveralls, leather gloves, eye and hearing protection, and two-way communication.

    a. Anti-contamination clothing may be required as directed by the RWP regulating the work site, or by the RWP specific to geophysical logging.

    b. Wells located in the 200 West Area near the 200 West Area Carbon Tetrachloride Expedited Response Action vapor extraction project must be surveyed with an organic vapor monitor (OVM) before being entered.

5.4 Equipment Cleaning/Decontamination

1. Cleaning: The logging cable shall be wiped with a 50% mixture of simple green and water and dried as the tool is withdrawn from the well. The tool may be wrapped with plastic sleeving. The cable wipes and sleeving shall be surveyed by a Health Physics Technician (HPT), unless previous arrangements have been made with an HPT. Equipment cleaning shall be documented by signature on the Borehole Survey Data Sheet.

2. Decontamination: Decontamination of logging equipment shall be performed and documented in accordance with sections of EII 5.4 appropriate for the equipment being used for the logging work.

6.0 FORMS

Borehole Survey Data Sheet (A-6000-663, Jetform)

7.0 RECORDS

Record processing and disposition shall be performed in accordance with the following table, and according to the details of records processing as described in EII 1.6.

Name Filing Unit Title or Description	Record Type*	Retention Period	Disposal Authority	Cut-off and Retirement Instructions
Borehole Survey Data Sheet (A-6000-663)	QA	TBD	DRS 1.8f	Logging geophysicist transmits completed Borehole Survey Data Sheet to the file custodian (FC). The FC copies the Borehole Survey Data Sheet and files (or transmits the copy to the appropriate file location) the copy in the project file, and transmits a copy to permanent storage per approved RIDS.
Calibration Certificate	QA	TBD	TBD	The original Calibration Certificate will be provided to the FC for transmittal to permanent storage per approved RIDS.
Optical Disks	Record	TBD	TBD	Duplicate optical disks will be provided to the FC and stored in record files.

* QA = Quality Assurance; TBD = To Be Determined

8.0 DESIGNATED REVIEWING ORGANIZATION

The organization designated to review changes to this document is listed below.

Designated Reviewers	CMPOC
Hanford Technical Services, process owner	STS/HTS

9.0 BIBLIOGRAPHY

American Petroleum Institute (API), 1974, RP 33, Third Edition, *Recommended Practice for Standard Calibration and Format for Nuclear Logs.*

ANSI N4212-1980, *American National Standard Calibration and Usage of Sodium Iodine Detector Systems.*

International Atomic Energy Agency (IAEA), 1982, Technical Reports Series, No. 212, *Borehole Logging for Uranium Exploration.*

WHC-SD-EN-TI-292, *Calibration of the Radionuclide Logging System Germanium Detector.*

WHC-SD-EN-TI-293, *Procedures for Calibrating Scintillation Gamma-Ray Well Logging Tools.*

APPENDIX A

SPECTRAL GAMMA-RAY LOGGING

1.0 APPLICABILITY

This appendix describes minimum technical requirements for borehole spectral gamma-ray logging to be performed by WHC. Spectral gamma-ray logs may be used to:

1. Delineate and characterize subsurface lithology.
2. Provide nondestructive, in-situ assays of gamma-ray-emitting nuclides that are present in subsurface lithologic units (using HPGe instrumentation).
3. Provide nondestructive, in-situ relative indications of subsurface lithologic units using scintillator instrumentation.

Instrument field verification and operation instructions presented, conform as much as possible to the *"Recommended Practice for Standard Calibration and Format for Nuclear Logs"* (American Petroleum Institute, 1974), as well as accepted uranium industry standards for spectral gamma-ray logging, *"Borehole Logging for Uranium Exploration"* (International Atomic Energy Agency, 1982).

2.0 DEFINITIONS

2.1 Equipment

Surface and subsurface equipment that operates a borehole detector under conditions of calibration supported configuration as defined on the geophysical logging system configuration.

2.2 Personnel Responsibilities

The logging geophysicist, or a logging technician, operates the logging equipment, ensures that the log data are properly recorded in an interim storage device, and ensures that the log data are transferred to a permanent mass-storage medium.

3.0 PROCEDURES

3.1 Preparations for Logging

3.1.1 Borehole survey data documentation

Use the Borehole Survey Data Sheet (A-6000-663, Jetform) to record pertinent information for each survey conducted.

3.1.2 Completing the Borehole Survey Data Sheet

1. If a particular data field is not applicable to a particular logging session, indicate by entering N/A in that field.

2. Make all log data entries with permanent black ink.

3. Line out corrections with a single line and place the correct entry as close as possible to the incorrect one. Initial and date the correction.

4. The Borehole Survey Data Sheet shall be signed and dated by the individual entering the information.

3.1.3 Calibration

A base calibration of the gamma-ray detection and recording systems is required once a year. The calibration shall be conducted at calibration models under DOE accepted standards (e.g., Hanford, WA, Grand Junction, CO), or other traceable standards of equivalent quality. A calibration is also required when system components are subjected to major repairs or alterations that change performance characteristics. The recalibration shall be completed as soon as practical after the repairs or alterations are completed.

There are two spectral gamma ray detection systems, utilizing the HPGe and NaI types of detectors. These systems require different calibration data analysis, since they provide different quality log data. The NaI detector has significantly poorer energy resolving power than the HPGe detector.

1. The NaI detector based logging systems will be calibrated as described in *Procedures for Calibrating Scintillation Gamma Ray Well Logging Tools Using Hanford Formation Models*, WHC-SD-EN-TI-293, Rev. 0. The collected calibration data will be analyzed in the manner described in the referenced document. Results of the analysis will be written to a page, (hereafter defined as "Calibration Certificate).

   The Calibration Certificate, containing the specified instrument calibration results, will contain the following information:

   - Unique system calibration configuration (includes the tool identification number and calibration system configuration)

   - Date calibration data collected

   - Signature by person responsible for calibration analysis and the date of signature

   - Equation, values of coefficients, and definition of units

   - Energy limits for validity of coefficients

- Electronic file name(s) for archived calibration and analysis data.

The original Calibration Certificate, along with any additional information pertinent to the calibration, will be processed as directed in Section 7.0 of this EII. Copies of the Calibration Certificate will be retained in Geophysics' Investigations' files, and on board the logging system defined in the Calibration Certificate.

2. The HPGe detector based logging systems will be calibrated as described in *Calibration of the Radionuclide Logging System Germanium Detector*, WHC-SD-EN-TI-292, Rev. 0. The collected calibration data will be analyzed in the manner described in the referenced document. Results of the analysis will be written to the Calibration Certificate. The Calibration Certificate for the HPGe instrument will contain the same type of information as listed above for the NaI instrumentation.

3.1.4 Elevation datum

Tool reference zero shall be the top of casing, except at drilling/well construction sites. At these sites, the tool zero reference shall be the estimated ground surface. The method of determining ground surface shall be documented on the Borehole Survey Data Sheet, and subsequent surveys shall use the same method.

1. Casing specifications shall be determined and recorded on the Borehole Survey Data Sheet, and the source shall be provided. At active sites, where ground surface is estimated, the casing stickup shall be recorded.

2. If water is present in the borehole, the level will be determined from top of casing and recorded on the Borehole Survey Data Sheet. If the water level is obtained from another source, the source shall be recorded.

3. Total depth of the borehole shall be recorded along with source of reference.

3.2 Field Operations

3.2.1 Prerequisites

Boreholes drilled, or existing, in areas where radioactive contaminants are known or suspected to exist in the subsurface shall be checked by swab test prior to logging. The swab shall be surveyed for radioactive contaminants by an HPT.

3.2.2 Equipment setup

1. Position logging truck to access well with logging tool.

2. Swing logging cable suspension boom to rear of truck.

3. Connect logging cable to logging tool.

4. Place logging cable over boom sheave wheel.

5. Suspend logging tool via cable over sheave wheel.

3.2.3 Program startup

1. Start computer logging control program.

2. Enter required information to access "calibration" screen.

3.2.4 Prelogging energy calibration

1. Attach field verifier to logging tool at preselected location.

2. Collect energy-calibration spectra.

3. Execute energy-calibration sequence.

4. Remove field verification source.

5. Adjustments to the logging instrumentation gain settings may be required: a) if the FWHM of the 911KeV peak is greater than 3.2; or b) the low energy detection limit is greater than 60KeV. Observations and adjustments shall be recorded on the Borehole Survey Data Sheet.

3.2.5 Logging

1. Cover logging tool with plastic sleeve (as appropriate).

2. Attach logging tool centralizer when the inside diameter of the casing is greater than 4 inches.

3. Position logging tool over borehole.

4. Position logging tool at "zero" position. (Center of detector is located at depth reference datum.)

5. Enter logging parameters into computer for automated measurement sequence.

6. Position tool and collect spectra.

7. Position tool and relog at least 5 data points using the same acquisition mode and logging parameters as used for the survey.

8. Have cable, tool sleeving, and tool surveyed for radioactivity upon completion of logging in each borehole, unless previous arrangements have been made with an HPT.

3.2.6 Postlogging energy calibration

Shall be conducted as described above in Section 3.2.4. Any deviations between the pre- and post- calibrations shall be recorded on the Borehole Survey Data Sheet.

3.2.7 Equipment takedown

1. Exit computer logging program.

2. Copy files from computer to optical disk and verify the recording on the optical disk.

3. Record field optical disk number and disk partition used on Borehole Survey Data Sheet.

4. Place logging tool onto the tool rack in truck, disconnect from the cable, and secure.

5. Remove logging cable from boom sheave wheel.

6. Move boom forward to traveling position.

3.3 Logging Activities Conducted Within Surface Contaminated Areas

Movement of logging equipment into and out of surface contaminated areas (SCAs) will be regulated in accordance with guidelines established for vehicle surveys from SCAs. Special instructions pertaining to logging activities in SCAs (e.g., dosimetry, personal protective equipment) are outlined in the RWP regulating geophysical borehole/well logging.

3.4 Records Disposition

When logging is completed, check the Borehole Survey Data Sheet (A-6000-663, Jetform) to ensure that:

1. All information is entered, legible and correct.

2. Abnormalities, observations, and adjustments are recorded in the "Notes" section.

3. Name, signature and date are recorded.

The logging geophysicist processes the logging documentation sheets as specified in Section 7.0 of this EII. The field optical disk will be retained in the logging unit. A copy of the data acquired and processed will be made on a second optical disk. This disk will be retained in Geophysics' Investigations' files. The files will be secured (locked), will be under fire protection conditions, and will have controlled access. As disks are filled, duplicate disks will be processed as described in Section 7.0 of this EII.

TITLE:

GEOPHYSICAL SURVEY WORK

Approved by

J. W. Cammann

J. W. Cammann, Manager
Geohydrologic Support

1.0 PURPOSE

This Environmental Investigations Instruction (EII) provides the minimum requirements for obtaining geophysical survey data.

2.0 SCOPE

This EII applies to all geophysical survey work conducted on the Hanford Site. This instruction applies to geophysical survey data collection by personnel and contractors (as provided in task orders, work orders, or statements of work). This EII relates specifically to Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) field activities but may be used for other investigations if applicable.

Minimum technical requirements for individual survey methods are/will be delineated in appendices to this EII. Site-specific survey requirements will be provided by individual work plans and/or sampling and analysis plans.

3.0 DEFINITIONS

See WHC-CM-7-7 Glossary/Acronyms section.

4.0 RESPONSIBILITIES

4.1 COGNIZANT MANAGER FOR RCRA/CERCLA UNITS

1. Appoint a geophysicist meeting the qualification requirements of section 5.2.

2. Ensure that the geophysicist remains cognizant of advances in geophysics for Hanford Site environmental investigations.

*This is a total rewrite; therefore, no revision bars are used to indicate changes.

4.2 REMEDIAL INVESTIGATION COORDINATOR/COGNIZANT ENGINEER

1. The remedial investigation coordinator directs CERCLA work, and the cognizant engineer directs RCRA work.
2. Request assignment of a geophysicist for a specific project.
3. Properly integrate and plan any required geophysics work by discussing the project with the geophysicist before issuing work orders or statements of work.
4. Obtain review comments from the geophysicist for work orders or statements of work that require or request geophysical surveys.
5. Interface with the geophysicist, as appropriate, to ensure that the geophysical work is performed in accordance with instructions in the work plan and procedures, and, when appropriate, a work order or statement of work and a contractor's procedures.

4.3 FIELD TEAM LEADER

1. Coordinate onsite activities.
2. Geophysics field team leader (FTL) (with concurrence of the remedial investigation coordinator/cognizant engineer): oversee and provide schedules for the geophysical work.

4.4 GEOPHYSICIST

1. Oversee and/or conduct geophysical work for assigned projects.
2. Review projects before work startup to ensure proper integration of geophysics requirements into the project.
3. Prepare requirements for inclusion in work orders and/or statements of work (at a minimum include the requirements given in section 5.3 of this EII).
4. Review and approve procedures/protocols prepared by contractors.
5. Interface as necessary with the contractors to ensure that approved procedures are followed and to review the work, data, and interpretations for the contracted work.
6. Prepare procedures for review and approval for geophysics work performed internally by Westinghouse Hanford Company (WHC).
6. Interface as necessary with other Environmental Division functions and other WHC organizations.
7. Remain cognizant of developments and advances in the field of geophysics as it applies to environmental investigations.

4.5 HEALTH AND SAFETY OFFICER

Perform health and safety monitoring in accordance with safe practices and any applicable site-specific health and safety documents or Job Hazard Analysis. Ensure that all work is carried out in compliance with the appropriate document.

5.0 REQUIREMENTS

5.1 SAFETY REQUIREMENTS

Geophysics activities within waste management units shall comply with any applicable site-specific safety documents and a Job Hazard Analysis prepared for geophysical surveys. As a minimum, surveys in other areas shall be performed in accordance with Section 6.2.1 of this EII.

5.2 GEOPHYSICIST QUALIFICATIONS

Selected requirements from the following list may be waived at the discretion of the cognizant manager. Such waivers shall be documented by memo or similar means and state the basis for the waiver.

The geophysicist must demonstrate training and qualification to the satisfaction of the cognizant manager (or alternate). In accordance with EII 1.7, the cognizant manager (or alternate) must document training and qualification to include the following:

1. Bachelor's degree or higher in geophysics, physics/geology, or a comparable earth science/mathematics or engineering discipline.

2. Formal educational background in geology and hydrology or two years comparable professional experience.

3. Demonstrated knowledge of geophysical methods, including methods for calibration and operation.

4. A working knowledge of interpretation techniques, including geologic integration.

5. Knowledge of operational aspects of general geophysical equipment, including detector types, electronic circuitry, and recording methods.

6. Demonstrated knowledge of the specific instrumentation for the particular techniques to be used at a site.

5.3 TASK ORDERS, WORK ORDERS, AND STATEMENTS OF WORK

Task orders, work orders, or statements of work requesting characterization work shall be reviewed by a geophysicist to determine if contracted geophysics should be included as a part of the work. When contracted geophysics is to be accomplished with the work, the geophysicist shall prepare a list of requirements to be included in or attached to the document.

The requirements list in the task order, work order, or statement of work shall contain at least the following:

1. Survey type and resolution required.

2. Equipment calibration requirements, if any (see Section 6.2.3).

3. Provision for preparation and submittal for WHC review and approval the geophysics protocols (before work begins) and the data and reports (at the conclusion of work).

4. Detailed special geophysics requirements, when applicable.

5. Training requirements in compliance with 29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response."

6. Records maintenance and transmittal to WHC.

7. Deliverables.

5.4 TRAINING

Geophysical survey personnel shall be trained for hazardous waste work in accordance with EII 1.1, "Hazardous Waste Site Entry Requirements." Exceptions to this requirement may be made on a case-by-case basis where geophysical survey personnel are working in support of nonintrusive activities in an area with no surface chemical or radioactive contamination. This requirement does not apply to personnel conducting geophysical survey work outside any designated waste management unit.

6.0 PROCEDURE

6.1 OPERATIONS

The geophysicist shall review the project with the FTL and discuss any special instructions for the particular project.

The geophysicist monitors (contracted work), performs, and/or supervises all geophysical work in accordance with approved instructions.

Appendices A, B, C, and D specify minimum requirements for currently used geophysical techniques. Additional geophysical survey requirements for individual sites or operable or treatment, storage, or disposal (TSD) units may be specified in the work plans.

6.2 GENERAL GEOPHYSICAL SURVEY PROCEDURES

The appendices attached to this EII describe specific operating instructions for geophysical survey methods currently used. These instructions cover instrument calibration and maintenance, data collection, and data processing requirements. The following paragraphs describe several broader aspects of survey procedures that pertain to all methods expected to be employed in site investigations.

6.2.1 Safety

In waste management (operable or TSD) units, conduct geophysics work in accordance with a Job Hazard Analysis or Hazardous Waste Operations Permit (HWOP) prepared for the work. When performing work outside waste management units or for other purposes, take the following minimum precautions:

1. Take care when walking over rough, bushy terrain and use substantial footwear.

2. Take proper precautions when working out-of-doors during periods of hot weather (e.g., wear a hat, recognize signs of heat stress, and carry sufficient drinking water).

3. Do not use vehicles on steep slopes or embankments which, in the judgment of the operator, cannot be safely negotiated.

4. Off-road vehicle use shall comply with WHC-CM-4-3, Industrial Safety Manual, Safety Standard T-4, "Off-Road Vehicle Safety."

6.2.2 Measurement Locations

Geophysical measurements are normally made along straight lines that are parallel to, and sometimes coincident with, surveyed grid lines. These reference grids are usually described in the corresponding Remedial Investigation/Feasibility Study (RI/FS) Work Plan and in statements of work for geophysical surveys. Normally, surveys are completed and stakes will be in place at these sites before geophysical field work begins.

The geophysicist and the remedial investigation coordinator determine actual density of geophysical traverse lines, taking into consideration the survey objective and the desired resolution for those objects. In addition, obstructions on the ground surface (e.g., bushes, rocks, surface debris, pipes, fences, posts, buildings, and fixed machinery) often make it impossible to collect geophysical data along perfectly straight lines. This is acceptable, but major deviation in relation to the objective shall be recorded in a field logbook.

6.2.3 Calibrations

The stability of survey instruments and the precision of the survey lines are more important than absolute calibrations of the instrument's responses. Therefore, it is necessary in each survey area to repeatedly collect data along at least one traverse or make repeated readings at a number of data stations for discrete data-point methods. The instrument calibrations that are useful for equipment used in a specific technique are outlined in an appendix for that specific technique.

6.2.4 Field Logbook

Describe the geophysical field work in a field logbook. Describe the site; explain the work and general field procedures being performed; list the instruments used; record instrument settings (when applicable); note anomalous occurrences; and describe details related to data collection (e.g., line numbers, traverse directions, obstructions, deviations, data-record numbers, and data-file names). In most cases, the actual data are recorded on other media. A separate logbook may be used by each individual or group performing independent field work.

6.2.5 Reports

Contractors submit final reports to WHC as outlined in the statement of work for an operable and/or TSD unit; WHC groups performing work also prepare reports. These reports shall include:

1. Site description.
2. Statement of survey objectives.
3. Outline of data collection steps.
4. Outline of data processing operations and data analysis methods.
5. Discussion of results.
6. Data display products (maps, profiles, and graphs).
7. Listing and description of the survey instrumentation.

7.0 RECORDS

Records are processed and dispositioned in accordance with the following table.

NAME Filing Unit Title or Description	RECORD TYPE*	RETENTION PERIOD	DISPOSAL AUTHORITY	CUT-OFF AND RETIREMENT INSTRUCTIONS
Magnetic-Data Reading, A-6000-684	R	TBD	TBD	Transmit to File Custodian (FC) when no longer needed by field personnel, and place in project file.
Seismic Observers Log Sheet A-6000-680	R	TBD	TBD	Transmit to File Custodian (FC) when no longer needed by field personnel, and place in project file.

* QA = Quality Assurance; NR = Nonrecord Material; TBD = To be determined

8.0 DESIGNATED REVIEWING ORGANIZATIONS

Organizations designated to review changes to this document are listed below. The controlled manual point-of-contact (CMPOC) listed for the designated reviewing organization(s) is responsible for coordinating the review and consolidating and submitting comments to the originating organizations.

Designated Reviewers	CMPOC
Documentation and Records Service	IRM/DRM
Geotechnology	RR/LWD

Comments from other organizations are welcome; however, such courtesy comments are dispositioned at the option of the originating organization.

9.0 FORMS

Magnetic-Data Reading, A-6000-684
Seismic Observers Log Sheer, A-6000-680

8.0 REFERENCES

"A Compendium of Superfund Field Operations Methods," Section 8, "Geophysics"

29 CFR 1910.120, "Hazardous Waste Operations and Emergency Response."

WHC-CM-4-3, Industrial Safety Manual, Safety Standard T-4, "Off-Road Vehicle Safety."

APPENDIX A

GROUND-PENETRATING RADAR

1.0 APPLICABILITY

Ground-penetrating radar measures variations in the reflected electromagnetic (radar) fields to detect and characterize natural or man-made features, objects, or materials in the ground. This method has proven effective at shallow depths (10 m or less) typical of near-surface chemical and radioactive waste burial sites. This method is routinely used to detect waste materials or subsurface structures (e.g., trenches, tanks, drums). It is also used to detect natural features (e.g., bedrock, the water table, voids, and sedimentary interfaces) that may influence the migration of chemical or radiological contaminants into the environment.

2.0 SURVEY EQUIPMENT

1. Control unit.
2. Antenna.
3. Calibrator.
4. Data acquisition unit.
5. Field-display, on-line monitoring unit.
6. Proper automotive vehicle to transport equipment during field operations.
7. Twelve-volt electrical power.
8. Manufacturer's operations manuals.

3.0 METHOD DESCRIPTION

The method is based on propagating pulsed electromagnetic waves and recording waves backscattered (reflected) from objects or interfaces in the ground.

It requires a controlling unit that both generates the pulsed wave and the proper time increment and regulates the recording of the backscattered wave. It can be placed in a stationary position if the area of investigation is small and within reach of the cable connecting this unit with the antenna. If not, the unit is usually mounted on a small all-terrain vehicle (ATV), and the antenna is towed behind. The antenna sends and receives the electromagnetic wave and actually travels over the ground surface.

The data are collected, and usually after some computer processing, are displayed in a "time section" showing the backscattered (reflected) waves representing the objects or interfaces from which they were reflected.

The accuracy of the data is ±0.5 nanoseconds in signal travel time.

4.0 PROCEDURE

4.1 CALIBRATION

Record radar travel-time calibration signal in the field as a special data record. Using the proper calibrator, calibrate the system at least once per day during field operations and whenever a change is made in the timing parameters of the radar system. Document calibration in the field logbook; also document the location of the calibration data in the recorded data set.

4.2 MAINTENANCE

1. Daily, inspect and (if necessary) clean cables, connectors, and tape recorder heads.

2. Daily, maintain all-terrain vehicle (gas, oil, tires).

4.3 DATA COLLECTION

_If_ towing the unit with the ATV, the operator either (1) uses a footage counter mounted on the ATV to provide position data that are automatically inserted into the data records, or (2) inserts position information.

Record the operating mode in the field logbook.

1. Normal travel speed: 2-5 feet/second

2. Warm-up time: 1 minute

3. System adjustments such as time scale, gain, filter, sampling rate, and signal frequency range (antenna selection) are site-dependent and are made at the discretion of the operator. Record all instrument settings in the field logbook.

4. Data are normally collected along straight lines defined by, or derived from, a survey grid marked by stakes. Record in the field logbook pertinent data (e.g., direction, location, track number, obstructions) relating to each traverse.

5. The radar data are recorded in digital form on magnetic tape cartridges or magnetic disks if required by specific sampling and analysis plans or if processing is intended. Label and record the date on each cartridge or disk.

4.4 DATA ANALYSIS

When appropriate, the radar data are processed by personal computer or another computer type. Processing steps may include scan edit, filter, geometric corrections, and image enhancement. Intermediate output products are normally amplitude-modulated radar profiles. The final product is normally a site map showing the interpreted locations, depths, and characteristics of the radar anomalies.

APPENDIX B

ELECTROMAGNETIC INDUCTION

1.0 APPLICABILITY

This appendix provides the minimum requirements and guidelines for conducting electromagnetic induction (EMI) surveys with a Geonics* EM-31 or EM-34 terrain conductivity meter. Use of a brand name in this instance is not intended to be an endorsement; however, there is no other commercially available equivalent instrument. This appendix provides procedures for conducting an EMI field survey, for handling and analyzing data, and for dealing with problems.

Electromagnetic induction measures electromagnetically induced fields propagated back to above ground surface to the instrument from objects in the earth, or in some cases layering in the soils, e.g., the water table. The amplitude of the signal is in proportion to the conductivity of the object or layer in relation to the conductivity of the surrounding soils. EMI surveys target metal objects (or collections of objects, in the case of landfills). Although it varies depending on soil type, the depth of investigation is approximately 20 feet for the EM-31 and 180 feet for the EM-34.

2.0 EQUIPMENT REQUIREMENTS

1. Geonics EM-31 series or EM-34 ground conductivity meter.
2. Data recorder (optional), called a data logger with this equipment.
3. Size "C" internal batteries.
4. Spare cables and batteries.
5. Manufacturer's operations manuals.

3.0 METHOD DESCRIPTION

The method is based on propagating electromagnetic waves into the ground and recording the strength of secondary waves generated by changes in soil conductivity or by buried metals, both ferrous and nonferrous.

The model EM-31 instrument requires a controlling unit that both generates the waves and regulates the recording of the secondary wave. Both the controlling unit and the transmitting and receiving unit (transceiver)

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*Geonics, Ltd., Ontario, Canada.

can be carried by a single individual. A second person is more expedient when a data logger is not used.

For the model EM-34 instrument, each antenna is separate from the controlling unit, and the system requires two people to operate the combined units of the instrument.

The data are collected and displayed in profile form along each traverse. High-amplitude segments on a profile indicate a substance, object, or layer of higher conductivity at depth.

When using a data logger, the instrument automatically collects both the in-phase and quadrature components. Either or both can be displayed, plotted, and used for interpretation.

3.1 DEFINITION

Conductivity (Earth Conductivity). This refers to the ability of a particular earth material to conduct electric current. In general, saturated rocks conduct better than nonsaturated rocks, clays conduct better than sands and gravels, and contaminated solutions conduct better than noncontaminated solutions.

4.0 PROCEDURE

4.1 INSTRUMENT CALIBRATION

Daily, check batteries to ensure that they are adequately charged for the day's work.

User-calibrate (functionally check) the instrument before and after each day's use in accordance with the applicable operating manual. Document the functional check in the operator's field logbook as stated below:

1. Equipment identifier (e.g., equipment model number, serial number).

2. Date and time of the functional check.

3. Initials of the individual performing the check.

If the functional check reveals instrument failure, send the instrument for repair and recalibration to the vendor or other approved repair facility.

4.2 DATA COLLECTION

1. Collect data in the orientation required by the complexity of the site and the targeted objective, as decided by the geophysics staff.

2. As appropriate, collect data along presurveyed grid lines that have been marked by stakes.

3. Proceed along the survey lines at a comfortable walking pace.

4. Carry the instrument at a consistent elevation that is comfortable for the operator (usually approximately waist level).

5. Keep the long axis (boom) of the instrument oriented parallel to the direction of the survey traverse line.

6. Data should generally be reviewed in the field as soon as reasonably possible after it is collected.

7. Check data for correct line numbering or site location.

8. When using a data logger, after data have been reviewed and stored on disk, document all steps in the operator's field logbook.

4.3 RECORD ANNOTATION

At a minimum, record the following information for each job site. When using the data logger, much of the following information is recorded in the header file instead of the operator's field logbook.

1. Site (or job) identification in accordance with the operable/TSD unit work plan.

2. Time and date.

3. Locations of any substantial collections of surface metal or other unusual surface features.

4. Significant variations in topography, such as slope breaks to the river, mounds, and cultural features such as fences, overhead power lines, and nearby buildings.

5. The operator's initials.

When the EM-31 is operated with a data logger, the operator has the ability to annotate the records through the console keypad directly to a header file.

A daily log must also be kept in the operator's field logbook. At a minimum, recorded information should include a list of which lines were run during the day; notes on any particular problems encountered, such as extreme terrain or obstructions like large bushes; and notes on general site conditions or peculiarities in site conditions. At the end of the day's log, the operator(s) shall sign, initial, date and enter the time. The operator(s) shall enter their printed name, signature and initials at least once for each operable/TSD unit.

4.5 DATA ANALYSIS

The data are appropriately processed (filtered, smoothed, diurnal removed) and plotted in profile form for each traverse taken. A plotted profile is the standard format for these data.

4.6 DATA COLLECTION CONFIGURATION VARIABLES

The sections that follow identify and discuss the data collection configurations that do not conform to some of the data collection procedures discussed.

4.6.1 Using the EM-31 Without the Data Logger

Occasionally the EM-31 is used without a data logger, e.g., in various orientations (horizontal dipole and/or with boom perpendicular to the direction of traverse), to confirm and/or further define anomalies. In such instances, the data may be either recorded in the data logger one point at a time, with proper annotation, or recorded separately in the field logbook. The latter method is preferred.

4.6.2 Option Modes While Using the Data Logger

When the data logger is employed, automatic recording of both the in-phase and quadrature modes occurs simultaneously. Either or both modes can be subsequently used for interpretation. The mode used depends on the survey objective. Record this information in the operator's field logbook.

4.6.3 Collecting Data in the Horizontal-Dipole Mode

The purpose of using the horizontal-dipole mode is to determine the depth of the source of the anomaly. However, because of its resolution, the EM-31 can only be operated in this mode under ideal conditions (e.g., no cultural interference to the signal from power lines, fences, or buildings), and with only one discrete subsurface object as the target.

4.6.4 Collecting Data with the Boom Oriented Perpendicular to the Direction of Traverse

This mode may be used for one of two reasons:

1. To better pinpoint the location of a long linear anomaly, such as a buried pipe.

2. To determine whether a particular anomaly is reflecting the presence of subsurface metals or natural geologic conditions.

APPENDIX C

SEISMIC METHODS

1.0 APPLICABILITY

Seismic surveys consist of measuring the response of the earth to a controlled acoustic input signal. The propagation of the acoustic signal is affected by the variations of the earth resulting in reflections, refractions, diffractions, and attenuation of the input signal. By processing the recorded data and properly displaying the reflected or refracted waves, the subsurface configuration can be determined. Depending on the equipment and energy sources used and the configuration of the earth-motion sensing instruments used, the subsurface configuration can be "mapped" from depths of a few feet to many thousands of feet.

2.0 EQUIPMENT REQUIREMENTS

Equipment required for seismic surveys is broken into four groups:

1. Seismic-energy generators (seismic sources).
2. Signal receivers (geophones).
3. Electrical-signal recorder unit.
4. Data processing unit.

The specific device used varies depending on the target and/or objective of the survey and material through which the acoustic signal must pass. Seismic sources also vary, from a blow with a sledge hammer to powerful explosives.

3.0 METHOD DESCRIPTION

3.1 SEISMIC REFLECTION

The reflected travel path is the seismic signal of interest for seismic reflection surveys. A seismic signal is generated by a seismic source at or near the surface of the earth. This signal propagates through the earth, reflects off subsurface interfaces, and returns to an array of geophones.

The geophone signals are digitally recorded, processed, and interpreted to yield information concerning the targets/objectives of the survey. Discrimination between primary reflected seismic waves and seismic waves that travel by other paths cannot efficiently be accomplished during the field data acquisition. In fact, more signals than desired are recorded. Therefore, data processing is required to enhance the desired signal (in this case the reflected wave) and suppress the unwanted signal. Several field practices may, however, reduce the unwanted signals. These include the use of appropriate recording unit filters, spatial filtering using strategically placed geophones and sources, and/or use of acquisition equipment with selective frequency responses.

The results of seismic reflection surveys yield profiled time-sections showing the response of the recorded seismic signal over a period of time as the vertical axis (1 second or so) along the seismic line, the horizontal axis. These travel-time-versus-distance sections are then geologically described to yield the best interpretation based upon current geophysical, geologic and hydrologic data.

3.2 SEISMIC REFRACTION

The seismic signals that follow a refracted pathway along subsurface interfaces are the primary waves of interest in seismic refraction surveys. Seismic waves refract along subsurface interfaces only when the seismic velocity of the lower interface is greater than that of the upper layer. Refractions occur when seismic signals generated at or near the surface travel downward and impinge upon a subsurface interface at a critical angle. The signal refracts along the interface and is retransmitted to the surface and the geophones. The geophone signals are digitally recorded, processed, and interpreted to yield information concerning the targets/objectives of the survey.

The discrimination of refracted signals from other seismic waves traveling other paths is somewhat less of a problem than with reflection surveys. The refracted signals are generally the first energy to arrive at the geophones. However, refracted waves travel farther than a comparable reflected signal, resulting in greater attenuation of the refracted signal. This results in a retrieved seismic wave of lower amplitude and with a lower frequency content. Thus, greater energy must be imparted into the earth to compensate for the attenuation.

The results of seismic refraction surveys yield a profiled cross-section of the arrival times of the refracted waves. Some geologic horizons may go undetected, because not all interfaces refract the signal back toward the surface. Also, dipping interfaces of more than approximately 20 degrees cannot be accurately compensated for, resulting in misleading calculated depths for the interfaces.

3.3 DEFINITIONS

Channel (or channels). The number of recorded seismic traces for a given seismic shot.

Geophone. Transducers that convert seismic vibrations to voltages using either motion of a magnet inside a coil or motion of a coil inside a fixed magnetic field.

Seismic record. The digitized numbers or the actual graphical display produced from recording the signal received from a single seismic shot.

Seismic trace. The graphical display of a signal received at a single seismic channel from a single geophone or string of electrically wired-together geophones.

Shotpoint. The location, or point, that energy is input into the ground to produce seismic waves, or signals.

Station. Numbered, sequential location on seismic line of geophone placement.

4.0 PROCEDURE

4.1 INSTRUMENT CALIBRATION

User-calibrate (functionally check) the seismic recording system before each day's use in accordance with the applicable vendor's/manufacturers's operating manual. Digitally record the system response during the functional check. Document the checks made on the Seismic Observers Log Sheet and/or in the field logbook, as appropriate. Record the following items:

1. Equipment identifier (e.g., equipment model number, serial number).
2. Date and results of the functional check including reference to appropriate oscillograph records.
3. Vendor/manufacturer operating manual used.
4. Initials of the individual performing the check.

If the functional check reveals failure of a part of the system, send the part for repair and recalibration or replacement to the vendor or other approved repair facility.

4.2 DATA ACQUISITION

The detailed equipment configurations for seismic data acquisition vary depending upon specific work plans, targets and/or objectives of the survey, and upon the equipment used. Record the actual data acquisition configuration in a field logbook and/or on the Seismic Observers Log Sheet (A-6000-680, Jetform).

1. Before collecting data, establish the seismic lines along which data are to be collected. Do this by placing flags or stakes in the ground at predetermined, measured locations in accordance with the survey objectives. (Use a chain or long tape measure to measure spacing.)
2. Also determine elevations for each flagged point. The accuracy of the elevations depends on the local geology and on the survey target/objective. Depending on requirements, elevations may be obtained from a topographic map or by surveying.
3. Plant the geophones in an upright, vertical position. Geophone configurations vary from a single geophone per channel to a group

of geophones wired together per channel. The groups (or strings) of geophones are often used for reflection-seismic surveys. Generally, single geophones are planted at flagged points. Individual geophones of a geophone string are usually planted at a paced distance from a flagged location.

4. Set up and connect the equipment, and perform functional checks in accordance with the operating manuals; record results as appropriate.

5. The geophysicist determines the location of the energy-source points (shotpoints). Multiple shots may be made at one location or may be located at slightly different locations for a single shotpoint. Record locations in the field logbook or on the Seismic Observers Log Sheet.

6. The data are recorded on magnetic media for later processing and storage. Hardcopy oscillograph records typically are recorded for each shot. Assign each "seismic record" on the magnetic media a "record number"; record that number in the logbook or on the Seismic Observers Log Sheet.

7. Label magnetic media before transporting it from the field. Include date, line number, starting and ending record numbers, disk/reel number, and other pertinent information.

Data collection is also a method of testing equipment configuration. The geophysicist is trained to evaluate the data and modify equipment configuration as appropriate to improve data collection for a particular site and its soil conditions.

All work is done at the direction of an experienced geophysicist, and all configurations of geophones, energy sources, and recording equipment must be recorded in the field logbook or on the Seismic Observers Log Sheet.

4.3 RECORD ANNOTATION

Records of seismic data acquisition activities can be logged in two possible locations. A field logbook is always used, and a Seismic Observers Log Sheet usually is used to supplement the field logbook. Entries in the field logbook should include:

1. The name and location of the survey site.

2. Names of personnel involved, especially the responsible geophysicist and seismic observer.

3. A listing of equipment used, with appropriate serial numbers.

4. Time and date of the field work.

5. Comment notes describing any variations in operation methods.

6. Documentation of daily activity specifying which shotpoints were shot and identifying the disks/reels of data acquired for that day.

7. At the end of the day's entries, the signature and printed name of the individual who entered the information into the logbook.

Items typically recorded on the Seismic Observers Log Sheet, as appropriate, in the "Comments" section include such things as shot misfires, repeat shots, skipped shots, and missing geophones.

In addition, a Seismic Observers Log Sheet may be used to describe each seismic shot.

4.4 DATA PROCESSING AND ANALYSIS

Data processing is used to refine and enhance the data. The actual data processing methods used depend on the quality of the data, survey target/objective, and desired type of data, i.e., refraction data or reflection data. In the final report for each project, discuss the processing and interpretation techniques used.

4.3.1 Seismic Reflection

Among the basic data processing techniques employed are filtering, convolution, Fast Fourier Transforms (FFT), and inverse filtering, i.e., deconvolution.

Specific data processing procedures that may be used are listed below, along with a brief description.

Deconvolution. The determination and application of inverse filters. These inverse filters may be designed to improve the frequency content of the data or to reduce the amplitude of multiple reflections.

Demultiplex. Changes the order of the data from a time-sequential series to a seismic-trace sequential series.

Filtering. The process of removing unwanted signals from the seismic records.

Frequency Analysis. The determination of the frequency content of the reflected seismic signal. Usually performed by passing the data through a series of narrow, band-pass filters and observing the pass-band regions that contain most of the reflected signal. This routine is used to determine the appropriate filters for the data.

Migration. The correction of seismic signals for the diffraction of the seismic signals caused by abrupt subsurface edges.

Many supplemental processing procedures not listed here exist and may be used. In the final report, discuss all processing steps actually used.

Mute. The digital "zeroing out of data" that is too contaminated with noise to be of interest or too distorted to be meaningful for the purpose of the survey. Used to clean up the early time periods of the traces and when signal stretch becomes significant; faster and more effective than filtering.

Normal Move-Out Corrections. The correction of the seismic data for the geometry of the field configuration. This correction may be applied to separate shots or to CDP Gathers.

Sort, or Common Depth Point (CDP) Gather. Collects all seismic traces that are assumed to have reflected from a common point at depth.

Stack. The adding or averaging of seismic traces from a CDP after velocity corrections have been performed.

Static Corrections. Adjustment of the reflection data for the time spent above a common datum plane. These adjustments result from the variations in the shotpoint and receiver elevation and the acoustic velocity of the material between the ground surface and datum.

Velocity Analysis. The determination of the average acoustic velocity of materials through which the seismic signal has traveled. These velocities are required to correct the data for the geometry of the field set-up used in acquiring the data.

4.3.2 Seismic Refraction

Data processing for refraction-seismic data is not as extensive as that for reflection-seismic data. Demultiplexing of the data may be required to place the data into trace-sequential form. The arrival of the first energy may be automatically determined, selected interactively, or may be hand picked from analogue records.

The most intensive data processing for refraction data is the determination of the geologic layering that produced the refracted energy. Several techniques used are the generalized reciprocal method, delay-time method, and slope-intercept method.

APPENDIX D

MAGNETIC SURVEY

1.0 APPLICABILITY

Magnetic surveys consist of measuring the earth's magnetic field at or near the earth's surface. A homogeneous earth produces a well-defined magnetic field, much like the magnetic field around a bar magnet. A magnetic survey detects the alteration of the local strength of the earth's field by ferrous materials such as steel or iron debris, pipes, fences, buildings, and from magnetic minerals in the soil and/or rock, generally iron oxides.

The amplitude of variations in this altered field (anomalies) are in proportion to the size of an object, its susceptibility, and its depth. The average field for the Hanford Site is about 56,000 gammas (a measure of magnetic fields, and variations in that field caused by the basaltic rock are about 400 gammas (see "A Compendium of Superfund Field Operations Methods"). Railroad tracks produce a variation (anomaly) of about 3,000 gammas, and three closely spaced (i.e., within about 20 feet) 200-foot-long, in-place well casings produce about 4,000 gammas.

This method can be used to detect subsurface ferromagnetic materials or to enhance and complement their detection by other methods quickly and easily without any disturbance to the ground surface other than walking across it. It is also used to detect natural features (e.g., basalt bedrock, faults in that bedrock) that may influence the groundwater flow paths. Depth of subsurface objects of interest can range from just below the surface to thousands of feet.

2.0 EQUIPMENT REQUIREMENTS

Equipment required for a survey is a sensor and the sensor-output detection/display device, in this case a crystal-controlled counter. The following components are needed for a survey:

1. Portable proton magnetometer sensor and visual display.
2. Power supply (e.g., nonmagnetic size "D" batteries).
3. Manufacturer's operating manuals.
4. Eight to 15-foot staff for the sensor.

3.0 METHOD DESCRIPTION

Performing a survey requires mounting a sensor on a staff and strapping on the harness with the display instrument in it, walking to a data point, and taking a reading. Data points are usually taken along parallel lines (traverses). Data are collected in a "stop-and-read" mode: the foot of the staff on which the sensor is placed is placed on the ground, the staff is held near vertical, and the reading is taken. Once the reading is taken, the sensor is carried to the next data point, and the foot of the staff is again placed on the ground.

4.0 PROCEDURE

4.1 INSTRUMENT CALIBRATION

The operation of a proton magnetometer is based on nuclear precession of the nucleus of hydrogen atoms or protons. Therefore, proton magnetometer sensors are inherently calibrated. The crystal-controlled counters are very stable but may require occasional factory calibration.

A functional check will reveal the need for a factory calibration. Before each survey, perform a functional check of the following in accordance with the operator's manual:

1. Ensure that the operators is free of ferromagnetic objects that would affect measurements.
2. Perform the functional check in a "clean" magnetic environment.
3. Check battery condition.
4. During readings, keep the sensor oriented approximately north, and hold it stationary.
5. Adjust the tuning switch to a position that produces maximum signal. For the Hanford Site, an initial setting of 56 kilo-gammas represents the approximate known magnetic field.
6. Check for repeatability of the measurement to within a few gammas within about one minute, keeping the sensor in the same position.

Note the following in the field logbook:

1. Equipment identifier (e.g., equipment manufacturer's model number and serial number).
2. Date and time of the functional check.
3. Initials of the individual performing the check.

If the functional check reveals instrument failure, send the instrument for repair and recertification to the vendor or other approved repair facility.

4.2 DATA COLLECTION

4.2.1 Total-Magnetic-Field Measurement

Before going to the field, call the National Oceanic and Atmospheric Administration Space Disturbance Center (303) 497-3235 in Boulder, CO and find out the geomagnetic field. To perform a survey, the geomagnetic field should be relatively quiet, with Boulder "k" values of 3 or less. For surveys designed to locate large, isolated magnetic anomalies, larger magnetic disturbances can be tolerated.

1. The operator must not be carrying ferromagnetic material that would adversely affect the measurements.

2. Carry the instrument with the sensor on an eight-foot-high staff.

3. Take readings with the sensor held steady in a vertical position oriented roughly north. Take multiple readings at each station if required in the work plan or if deemed appropriate by the operator and/or geophysicist.

4. Record time every five minutes or every five data points (whichever comes first), at the beginning and end of each traverse, and any other time the flow on the traverse is broken.

5. Record data-point readings, station identifications, and time as required (to the minute on the operator's watch) on a Magnetic-Data Readings form (A-6000-684, Jetform).

6. Data are typically taken along traverses. Pacing or approximating the data-point locations along the traverse lines is normally sufficient for most surveys. Determine more precise data-point locations if required by the geophysicist or the project cognizant engineer.

7. Diurnal variations in the earth's magnetic field are monitored in one of two ways. One method is by recording the magnetic field continuously at a fixed base station using a base-station recorder. An alternative method requires taking measurements at a fixed location (usually a centralized data point within the survey area) at least hourly. Apply corrections for diurnal variations to the survey data <u>if deemed necessary</u> to meet the survey goals.

4.2.2 Vertical-Gradient Measurement (optional)

In the vertical-gradient (VG) mode, take total-field readings at a minimum of two elevations at each data-point location. Take the readings as near in time as possible. Maintain a fixed elevation difference between the two readings throughout a given survey. A five-foot differential between elevations, with the lower elevation at eight feet, provides an acceptable VG measurement. Other steps in data collection for VG measurements are the same as for total-field measurements, described in section 4.2.1, with the exception that the diurnal magnetic field does not need to be monitored.

4.3 RECORD ANNOTATION

Record at least the following information daily for each job site, either on a digital data logger or in the operator's field logbook.

1. Site (or job) identification in accordance with the operable or TSD unit work plan.

2. A list of the traverses for which data were collected that day.

3. Locations of any substantial collections of surface metal or other unusual surface features.

4. Notes on significant variations in topography, such as slope breaks, mounds, and obstructions, and cultural features, such as fences, overhead power lines, and nearby buildings.

5. At the end of the day's log, the operator(s) must date and sign the field logbook.

NOTE: In the field logbook, the operator(s) shall enter their printed name, signature and initials at least once for each operable or TSD unit.

Complete the Magnetic-Data Readings form as appropriate; place a short dash in cells not requiring data. Because the value of the X and Y coordinates (X-cor and Y-cor) will probably not be known in the field, those cells may be left blank to be filled in at a later date.

4.4 DATA ANALYSIS

The data will be processed as deemed appropriate and may include filtering, interpolation, adjustments for the ambient field, and removal of diurnal effects. Plot data in profile form; if appropriate, produce contour maps. The final product is typically feature maps showing the location of magnetic anomalies and possible ferromagnetic wastes. Results from other geophysical surveys of the site may be plotted on the same maps.

TITLE:

GLOSSARY/ACRONYMS

Approved by

B. J. Hobbs, Manager
Project Support

1.0 PURPOSE

This section of the manual provides a glossary of terms and abbreviations/acronyms used in environmental investigations instructions (EII).

2.0 SCOPE

This section provides an approved centralized list of words and their definitions for users and readers of the Environmental Investigations and Site Characterization Manual, WHC-CM-7-7.

2.1 Selection Criteria

The objective of the glossary of terms is to provide a common reference that is complete, concise, consistent, integrated, authoritative, and traceable. The selection criteria used to achieve these objectives are outlined below. Reference to the upper tier source document is provided (when available).

1. The glossary shall be a compilation of U.S. Department of Energy (DOE), Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement), and Hanford Site Contractors glossaries that are accepted by the DOE for use on the Hanford Site. Terms may also be derived from technical manuals/journals.

2. Commonly used terms found in a desk dictionary (e.g., Webster's Dictionary) are excluded unless clarification is needed for the application of terms specific to site characterization and environmental investigations.

3. Technical terms requiring extensive discourse for a particular application and that are uniquely applied in a single procedure may not appear in this glossary. Such terms shall be defined where applicable, in the procedure where they occur.

4. Terms developed and used during operations at the Hanford Site.

2.2 References and Use of the Glossary

Definitions in this glossary come from multiple sources. Some definitions may be a combination of two reference sources. Where applicable or when possible, an abbreviated reference source(s) is shown in parentheses following the definition. The Source Abbreviations and Listing Table is a listing of sources and titles of the references.

2.3 Maintenance

The glossary will change as EIIs and upper-tier documents change and as site characterization/remediation progresses. Revisions to this section of WHC-CM-7-7 are initiated by a CMDCR and processed in accordance with applicable requirements of EII 1.2.

3.0 GLOSSARY

accuracy

The degree of agreement of a measurement (or an average of measurements of the same thing). X, with an accepted reference or true value, T, usually expressed as the difference between the two values, X - T, or the difference as a percentage of the reference or true value, 100 (X-T)/T, and sometimes expressed as a ratio, X/T. Accuracy is the measure of the bias in a system. (QAMS-005)

action assignee

An individual assigned responsibility for the resolution of a particular Readiness Review action list item. (WHC-CM-1-3, MRP 5.50)

air monitoring

Infers a long-term air surveillance program to evaluate the environmental impact of a site, to help establish criteria for safety of workers and the public, and to determine mitigation activities. Air monitoring normally utilizes direct reading instruments installed in sampling stations which remain in one position for long periods of time. (OSWER 9355.0-14)

analytical laboratory data package

Consists of documentation (hardcopy) generated during transport and receipt of field samples, sample movement in the laboratory, preparation for analysis, laboratory analyses output, raw and processed data, analytical results, reanalysis, quality control sample results, and instrument calibration data, plus a summary of final results for each batch or Sample Delivery Group (SDG). (Hanford)

approval designator

An indicator of the reviews and approvals required by the DOE and WHC to verify that environmental, safety and quality assurance requirements are addressed.

aquifer testing

Refers to physical testing methods to determine the hydrologic characteristics of confined or unconfined aquifers. The methods used in this EII include the displacement of water in a well by the use of a rod (slugging rod) and the monitoring of the water level in the well during recovery (slug test). The other method involves pumping a constant discharge of water from a well and then monitoring water levels during water level draw-down and later recovery when the pumping stops (pumping and recovery test). Water level monitoring during a pumping and recovery test may be limited to the well pumped, but should include one or more nearby observation wells that are not pumped. (Hanford)

blind sample

A sample submitted for analysis whose composition is known to the submitter but unknown to the analyst. A blind sample is one way to test proficiency of a measurement system. (Hanford)

biotic

Biotic refers to plants and animals, living or dead (or caused or produced by biota). (Hanford)

borehole log

The record of the events and the type and characteristic of formations penetrated in drilling a borehole. (USBM)

centralized waste container storage area

Operable unit-specific, centralized location(s) where contained waste is stored pending final disposal. (Hanford)

chain of custody

The history of the transfer of samples from the time of sample acquisition to receipt by the laboratory. Chain of custody documentation is required as evidence of sample integrity. (OSWER 9355.0-14/ SW-846 modified)

comparability

Expresses the confidence with which one data set can be compared to another.

completeness

A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions.

complete case file purge

Laboratory records received or generated for a specific case that have not been previously submitted to WHC as a deliverable. These items include, but are not limited to: sample tags, custody records, sample tracking records, analysts' logbook pages, bench sheets, instrument readout records, computer printouts, GCMS tapes, raw data summaries, instrument logbook pages, correspondence and the document inventory. (EPA CLP Statement of Work)

computerized data retrieval system

The personal computer database system established to maintain a complete record of the type and location of every sample in the HGSL and tests performed on specimens. This computer database is maintained and controlled by the geotechnical sample library File Custodian (FC) in accordance with WHC internal requirements for computers and software.

consistent reading or measurement

Readings shall be considered consistent when they are:

- Within ± 0.02 ft (6mm) when taken with a weighted measuring tape
- Within ± 0.04 ft (12mm) when taken with an electrical water level measuring device. (Hanford)

continuous water-level recording device

Used to record changes in water level over a continuous period of time during an aquifer test. It generally consists of a downhole float and balance, a recording chart drum, and a clock-driven pen. Certain types of devices use a downhole pressure transducer that converts water pressure to an electronic signal; such signals are continuously timed and stored on memory pending transferral to magnetic disks. Depending on the capabilities of the equipment, water levels may be recorded in terms of pressure or may be converted automatically to depth. (Hanford)

contract required quantification limit (CRQL)

The lowest analyte concentration that the laboratory can be expected to achieve consistently and agreed upon contractually between the analytical services requestor and the laboratory. (Hanford)

courtesy reviews

Reviews of CM documents by individuals and organizations other than those listed in the documents as designated reviewers, performed at the option of the reviewing organization. (Compare with "designated reviews.")

cross-contamination

The transfer of contaminants via equipment or personnel from the contamination source to less contaminated or noncontaminated samples or areas.

custody

The physical responsibility for sample integrity, handling, and/or transportation. Custody responsibilities are effectively met if one or more of the following criteria are met:

1. In the individual's physical possession.
2. In the individual's direct observation after having taken possession.
3. Secured by the individual so that no tampering can occur.
4. Secured or locked by the individual in an area to which access is restricted to authorized personnel only. (OSWER 9355.0-14 modified)

custody seals, evidence tape

Security tape or other similar material affixed such that tampering with samples or containers during transfer will be apparent. (SW-846 modified)

dangerous waste

Those solid wastes designated in WAC 173-303-070 through 173-303-103 as dangerous or extremely hazardous wastes. As used in this manual, dangerous wastes will refer to the full universe of waste regulated by WAC 173-303.

data qualifier

A standardized flag (usually alphabetical character) that is applied to the data as a result of the validation process to provide an objective indication of the quality of a data set or a measurement or observation. Data qualifiers indicate whether or not specific procedural and/or technical requirements were met during the collection and analysis of the data and provide an indication to the technical user of any limitations on usage of the data. (Hanford)

data quality

The totality of features and characteristics of data that bears on its ability to satisfy a given purpose. The characteristics of major importance are precision, accuracy, representativeness, completeness, and comparability (PARCC).

data quality objectives (DQO)

Qualitative and quantitative statements which specify the quality of the data required to support agency decisions during remedial response activities. (Predetermined objectives or goals for measurement data in terms of precision, accuracy, completeness, and representation). (EPA/540/G-87/003 and DOE-RL-90-28)

decontamination

The practice of removing measurable contaminants from a surface to a specified, safe level. (Hanford)

description of work (DOW)

A document that provides performance details and controls for sampling and field activities in support of the activities identified in Section 2.0.

designated reviews

Reviews of CM documents by organizations specifically listed in the designated reviewers section of the documents. Designated reviewing organizations are those organizations that are either of the following:

a. Specifically called out by organization name for responsibilities or tasks, or

b. Accountable for establishing the requirements or processes in the document (that is, responsible for setting up the requirements and processes, not complying with them only).

Compare with "courtesy reviews."

direct reading instruments (DRI)

Instrumentation operating on flame-ionization, photoionization, or infrared principles providing real-time readings of airborne contaminants, usually in parts per billion in air. (OSWER 9355.0-14)

document

Any written or graphic information describing, defining, specifying, reporting, or certifying activities, requirements, procedures, or results. (WHC-CM-4-2, Glossary)

double blind sample

A sample known by the submitter but submitted to an analyst in such a way that neither its composition nor its identification as a check sample are known to the analyst. (Hanford)

"dump" purgewater

Purgewater containing constituents in concentrations lower than specified collection criteria which can be discharged to the soil column. (Strategy Document).

EDT file

An informal compilation of technical data/documentation (e.g., engineering notes, preliminary calculations, ancillary technical information, etc.) that is retrievable through the use of the EDT number. This data category will be processed through Configuration Management (CM) and transmitted to Information Resource Management (IRM) for archiving. The EDT File is retained as a record for 2 years per the Records Inventory and Disposition Schedule (RIDS) General Records Schedule (GRS) 23.5a. The document originator will be notified upon expiration of the retention period, and will be requested to justify further retention of the documentation. The EDT File does not include commercially available documents, library-type items, or computer software media such as floppy disks and tapes. The EDT File is a convenience file and will not be used for initial release of engineering documents, nor used for transmittal of personal records or documents collected for personal use.

eductor pipe

The pipe used in airlifting that transports the discharge water to the surface. (Groundwater and Wells)

electric sounder

A water level measuring device that uses a light gauge/buzzer sounds to show that the end of the line has entered the water. The water in the well completes an electric circuit that, in turn, turns on the light, shows deflection on gauge or sounds a buzzer. The line is graduated to show the depth. The electric sounder cannot be used where hydrocarbon products are present. (Hanford)

engineer's package

The document package received by the engineer (Project Coordinator). The package consists of copies of the validation documentation (including the Case Narrative for Contract Laboratory Program [CLP] data packages), verification form, Summary Table and an office of Sample Management (OSM) transmittal letter. (Hanford)

environmental data management center (EDMC)

The Environmental Division's central facility and service that provides a file management system for processing environmental information. (WHC-EP-0219)

environmental restoration program information center (EPIC)

The central facility and services, including satellite facilities, that provide processing and retrieval of ER program information (data, documents, and records) utilizing existing company systems to control documents and manage records.

field duplicate sample

Independent samples that are collected as close as possible to the same point in space and time. They are two separate samples taken from the same source, stored in separate containers, and analyzed independently. These duplicates are useful in documenting the precision of the sampling process. (Hanford)

field logbook

See EII 1.5, "Field Logbooks," Section 3.0.

field screening

Utilization of field instruments and/or field test kits for the purpose of segregation potentially hazardous or radioactive waste from unknown waste. Field screening will include the monitoring of drill cuttings, soils, and slurries for radioactivity, organic vapors, corrosivity, reactivity, and combustibility utilizing the following instrumentation/ methodologies:

- RAD - Radiation detection instruments (e.g., count-rate meters, Micro-R meters)
- Organic Vapors - Organic Vapor Monitors (e.g., OVMs, portable GCs)
- Corrosivity - pH meter (reference WAC 173-303-090)
- Reactivity - Process knowledge and instrument/test kit detections
- Combustibility - Combustible gas meter if OVM/HNU readout capabilities are exceeded.

NOTE: Instruments and/or tests other than those identified above may be utilized as appropriate. (Hanford)

file custodian

An individual who is responsible for receipt, storage, maintenance, control, and disposition of sample information or other records generated in support of Environmental Division (ENV) activities.

generated waste

Waste, other than purgewater that exists as a result of active field characterization or well maintenance activities. (Hanford) geologic logging

Detailed, systematic, and sequential record of the progress of drilling a well or borehole. (OSWER 9355.0-14)

geotechnical sample

Any type of geologic material that is collected for archival, data analysis, or testing. This includes, but is not limited to, rock and soil. Geotechnical samples are classified as samples, specimens or subspecimens. (Hanford)

geotechnical test boring (borehole)

Any temporary borehole (either cased or uncased) used primarily for the purpose of obtaining geologic or geotechnical data about subsurface soil or rock conditions, and/or determining groundwater levels. In the context of this procedure, a borehole will have a limited-time use, after which it will be eventually plugged/filled and abandoned.

geotechnical boreholes (vadose wells)

Any temporary cased borehole completed primarily for the purpose of obtaining geologic, or geotechnical data about subsurface soil or rock conditions, and/or for determining groundwater levels. (Hanford)

Hanford environmental information system (HEIS)

A computerized database used to store, manipulate and retrieve the data that are gathered from many types of environmental samples taken at the Hanford Site. The HEIS consists of a Sequent S27 UNIX-based multiprocessor computer and ORACLE software, support hardware, and data. (WHC-EP-0372)

Hanford environmental information system (HEIS) data package

A collection of validated laboratory and field data and documentation including Sample Identification and Data Entry Form (SIDEF) and Borehole Identification and Data Entry Form (BIDEF) described in WHC-EP-0372. For CERCLA projects, the data package also includes an electronic copy of the CLP data on diskettes (invalidated) and a hard copy of the OSM Summary Table. (WHC-EP-0372)

Hanford geotechnical sample library

The term HGSL refers to all facilities used to permanently store geotechnical samples. This includes the following storage facilities:

1. BAY 19, 2101M Building, 200 East Area. Primary sample storage facility used to store samples (including drill cuttings and split-tube samples) collected in support of WHC siting, construction, environmental, and waste management activities.

2. Warehouse at Big Pasco Industrial Park. Secondary sample storage facility primarily used to store core samples collected in support of the Basalt Waste Isolation Project (BWIP), Skagit/Hanford Nuclear Project (PSPL), and Environmental Restoration. Since the termination of BWIP and PSPL, the Environmental Restoration Program has assumed responsibility and control for these samples in support of their mission at the Hanford Site.

hazards assessment (HA)

Assessment performed to determine safety classification and design requirements for facilities and activities and to develop safety analysis reports, as required. (WHC-CM-4-3, HWO-1)

hazard classification

Hazards are organized into the following four classes:

1. None. Those activities that present no onsite or offsite impacts to people or the environment.

2. Low. Those activities that present minor onsite and negligible offsite impacts to people or the environment.

3. Moderate. Those activities that present considerable potential onsite impacts to people or the environment but, at most, only minor offsite impacts.

4. High. Those activities with the potential for onsite or offsite impacts to large numbers of persons or major impacts to the environment. (WHC-CM-4-46)

hazardous waste

(EPA term/Dangerous Waste Ecology term) Nonradioactive solid waste as defined in 40 CFR 261, as requiring special handling, transportation, and/or disposal methods; and as defined in WAC 173-303-040, as those solid wastes designated as dangerous or extremely hazardous waste in accordance with WAC 173-303-070 through 173-303-103.

hazardous waste site

Any location where operations take place that expose or potentially expose employees to hazardous wastes, hazardous substances, or any combination of hazardous wastes and hazardous substances. (29 CFR 1910.120)

HEIS sample number library (HSNL)

A computer-based sample number generation and tracking system within the HEIS. (WHC-EP-0660)

heterogenous

Consisting of or involving dissimilar elements or parts. (Webster's Dictionary)

homogeneous

Of the same or similar nature or kind. Uniform throughout in structure or make-up. (Webster's Dictionary)

indoctrination

Attendance at oral presentation(s) or completion of assigned reading of specified documents to gain understanding of principles and technical objectives.

in-process document

Incomplete records that require extended time for completion.

instrument custodian(s)

Personnel assigned responsibility for control of instruments; this includes physical control of instruments as well as monitoring data that may be stored in memory. (Hanford)

letter of instruction

A letter to the Hanford Site Engineer/Constructor, other onsite contractors, or another WHC organization that contains specific instructions, technical objectives, and requirements for design, construction, or other work to be performed. (WHC-CM-6-2)

mandatory training courses

Courses required by company manuals or external sources before associated work can be performed, such as Radiation worker Training.

mean

The arithmetic average of the individual values in a sample set. In a sample set of X units, the sample mean is calculated as the sum of the observed values in the sample set divided by the total number of units in the sample set. (QAMS-005)

measurement point

A fixed, clearly defined mark from which the depth-to-water in a well is measured. The measurement point is located at the well head on a well seal, pump plate, etc., depending on the appurtenances installed in the well. In some cases the measurement point will be the same as the reference point. (Hanford) minor field deviation

A change in an RI/FS or RFI/CMS operable unit work plan having no adverse effect on the work schedule, the overall cost (±10%), or the technical adequacy of the job. (TPA)

mixed waste

Radioactive waste that is also hazardous, dangerous or toxic. (WHC-CM-7-5)

open item list

A formalized listing of outstanding Readiness Review action list items that must be satisfied as a condition of Readiness Review approval but are considered sufficiently specific and routine that final approval authority is specifically delegated without further Readiness Review Board action. Two types of Open Item Lists used in this EII are (1) the Prestart Open Items List, which requires completion or resolution prior to start of field activities; and (2) the Poststart Open Items List, which requires completion or resolution after start of field activities. (WHC-CM-1-3, MRP 5.50)

performance audit

Procedures used to determine quantitatively the accuracy of the total measurement system or component parts thereof. (QAMS-005)

precision

The measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist, depending upon the "prescribed similar conditions." (QAMS-005)

primary document

Documents which contain information, documentation, data, and proposals upon which key decisions will be made with respect to the remedial action or permitting process. Primary documents are subject to dispute resolution and are part of the administrative record. (TPA)

primary laboratory

The laboratory being evaluated for performance in the area of accuracy/precision of the laboratory's measurement system. (Hanford)

process knowledge

A scientific determination based on the examination of available types of published data that would lead a scientist or engineer to believe there is a strong probability that hazardous waste materials exist at a site or area.

project file

The body of records applicable to a waste site necessary to demonstrate regulatory compliance, to show compliance with governing requirements (regulatory and DOE), and to provide a traceable project history. It is a gathering of information that substantiates, supports, or documents a specific scope of work identified in the ER Program work breakdown structure. (WHC-EP-0430)

purgewater

Water that is removed from a well during development, remediation, maintenance, aquifer testing and sampling activities. (Strategy Document)

qualification

The characteristics or abilities gained through education, training, or experience that qualify an individual to perform a required function.

qualified hazardous waste worker

A field worker who has completed the requirements. (29 CFR 1910.120)

quality affecting record (quality assurance record)

Information contained on any media, including but not limited to, hard copy, photo copy, and electronic systems that is complete in terms of appropriate content and furnishes evidence of the quality of items and/or activities affecting quality. (WHC-CM-3-5)

quality assurance record

A completed document that furnishes evidence of the quality of items and/or activities affecting quality. (WHC-CM-4-2)

radioactive waste

Solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act of 1954, as amended, and of negligible economic value considering costs of recovery. (WHC-CM-7-5) raw water

Hydrant water from the 200 area that is discharged into the storage facility to maintain the mandatory 6 inches purgewater level. (Strategy Document)

readiness tree

An analytical graphic display that indicates, in general terms, those elements that must be considered in establishing a state of readiness. (WHC-CM-1-3, MRP 5.50)

record of decision

The document used to select the method of remedial action to be implemented at a CERCLA unit after the Feasibility Study/Proposed Plan process has been completed. (WHC-CM-1-3, MRP 5.50)

records inventory and disposition schedule (RIDS)

A listing of the filing units and general files of an organization setting forth their mandatory disposition in terms of retirement, disposal, or transfer to storage after specified retention periods. The schedule includes all file material including record and nonrecord material and classified or unclassified information. It also includes 3records designated for permanent retention and those scheduled for disposal. (WHC-CM-3-5)

reference point

A fixed, clearly defined mark on the top of the well casing. The reference mark shall be surveyed to the National Geodetic Survey Vertical Control, 1929, and to the State Plane Coordinate Reference System (Washington South Zone) for horizontal control. (Hanford)

regulated equipment

Equipment which has been posted by Health Physics as having radiological contamination (fixed or loose) on its surfaces. (Hanford)

report form flags

Generated by CLP laboratory, i.e., M (Method), Q (Flag), and C (Concentration). (Hanford)

representativeness

Expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

resource protection (RP) well

Monitoring wells, observation wells, piezometer wells, spill response wells, and cased geotechnical boreholes (Vadose Wells). (WAC 173-160-030)

routine water-level monitoring

The measurement of water levels used for determining the elevation of the groundwater in selected wells in, or in the vicinity of, operating areas for use in preparing water table, potentiometric or piezometric surface maps, or well hydrographs. (Hanford)

sample

A natural material removed from its geologic environment and stored in the HGSL. It does not include portions of the original natural material that have been removed for testing. Types of samples specifically addressed are as follows:

1. *Drill Core. The rock or soil sample (including split-spoon samples) taken as core during the drilling process.*

2. *Drill Cuttings. The fragmentary rock or soil particles produced in the rotary, cable-tool, or auger drilling processes; also referred to a "chip" samples.*

3. *Grab Sample. Lithologic material (e.g., bedrock, detritus, soil, etc.) that has been collected at the earth's surface; also referred to as a "hand" or "field" sample.*

sampling equipment

Any equipment that is in direct physical contact with the sample, such as bottles, spoons, bowls, split barrel liners, or drive barrel liners. (Hanford)

sample identification tag/label

A tag or label generated by sampling personnel used to record data describing the sample number, type of sample, sample source location and date of collection, intended analyses, special handling requirements (if any) and the name of the sampler. (Hanford)

satellite accumulation area

A location at or near the point of waste generation where suspected or known hazardous, acutely hazardous or mixed waste is accumulated. At the point when more than 55 gallons of suspected or known hazardous or mixed waste or 1 quart of acutely hazardous waste is accumulated, the Facility Generator shall mark the container(s) holding the excess with the "accumulation start date" and transport the container(s) to a temporary storage facility within 72 hours. (WHC-CM-5-16)

secondary document

As distinguished from Primary Document, it is considered to be a supporting document providing information or data and does not, in itself, reflect key decisions. A secondary document is subject to review by the regulatory agencies and is part of the administrative record. It is not subject to dispute resolution. (TPA)

sediment

Solid material that has settled down from a state of suspension in a liquid. In the singular, the term is usually applied to material held in suspension in water or recently deposited from suspension. In the plural, the term is applied to all kinds of deposits and refers to unconsolidated materials.

soils

All unconsolidated materials above bedrock. This includes Hanford and Ringold Formations as well as Holocene sands and gravels. (American Geological Institute, "Glossary of Geology," 2nd Edition.)

specimen

A portion or split of a sample that is directly examined, consumed, etc., during the course of an analysis.

specimen interval

The footage interval of borehole-derived (core or chips) samples removed for testing/analysis. For samples not from a borehole, specimen interval is the unique number that identifies that sample (e.g., sample number). This number should be the original sample number followed by a dash (-) followed by a number

split laboratory

The laboratory performing analysis of split samples (field). The data generated from the analysis are used to evaluate the data from the analyses performed by the primary laboratory on samples from the same source. (Hanford)

split sample (field)

Samples taken from a single homogeneous medium, placed in separate containers and forwarded to separate laboratories for analysis by the same method/protocol. (Hanford)

standard deviation

The positive square root of the variance (ASTM 1988). A measurement of the dispersion around the mean of a sample set. (ASTM 1988) statement of work

Written direction from the contracting organization to a contractor including WHC organizations that defines the services to be provided. (Hanford)

steam cleaning

The use of high pressure, high temperature water to wash flush contaminants off equipment. (Hanford)

stock troughs

Covered containers placed at well sites that were used for temporary storage of purgewater. (Strategy Document)

storage facility

Above-ground units that are used for storage of purgewater which is awaiting solar evaporation. (Strategy Document)

subspecimen

The end product of a specimen having undergone analysis/testing. Examples include x-ray fluorescence beads; microscopic thin sections and billets; fragmented, crushed and pulverized specimen; laboratory archives, etc. (Hanford)

summary table

A hardcopy and/or computer-readable record containing, at a minimum, the validated analytical results obtained for a sample or set of samples, including a copy of OSM's changes (Data Qualifiers) to the original laboratory's (CLP) Report Form Flags. This information is copied from the laboratory data package and provided to the Project Coordinator as part of the Engineer's package. (Hanford)

suspected hazardous waste

Nonradioactive solid waste that meets the criteria for suspected hazardous waste based on process knowledge and either direct instrumentation reading of organic vapor in excess of 10 ppm above background levels, 1 foot above freshly excavated soil, or a pH less than 3 or greater than 12. (WHC-CM-5-16)

suspected mixed waste

Radioactive solid waste that also meets the criteria for suspected hazardous waste. (WHC-EP-0063) suspect waste site

Any site, not documented in the WIDS, that may have been used for waste disposal or to contain dangerous waste, hazardous substance, and/or radioactive waste.

tank trucks

Trucks mounted with steel tanks used to transport purgewater from point of generation to the disposal location. (Strategy Document)

temporary storage facility

A temporary waste accumulation area for any quantity of suspected or known hazardous, mixed or acutely hazardous waste for up to 90 days maximum duration, i.e., "90 day pad". (WHC-CM-5-16)

unknown waste

Drill cuttings, decontamination fluids, materials, cloths, wipes, grab samples, and well maintenance soils/slurries from a hazardous waste site having no indications from initial field investigations that hazardous or radioactive material is present at the time of placement within the container.

Unknown waste containers are those with known physical characteristics (solid, liquid, slurry, etc.) but unknown chemical characteristics; differentiating from unfamiliar (orphan) containers with unknown physical and chemical characteristics, such as ones found at abandoned waste sites. (Hanford)

vadose zone well

A well constructed to a limited depth, not penetrating below the water table, which is used for leak detection and to monitor transport of contaminants above the water table.

validation

The final act by authorized personnel that ensures a document is complete and accurate in terms of its appropriate content and provides traceability to the responsible individual or organization. (WHC-CM-3-5)

valid data

Data that meets specified validation/quality checks that are sufficient to meet the stated objectives for decision making purposes.

variance

A measure of the dispersion of a set of measurements. It is the sum of squares of the individual deviations from the sample mean divided by one less than the number of results involved. (ASTM 1988) visitor

Any person who visits a hazardous waste site for any reason. (CFR 1910.120)

waste

Material that is discarded, abandoned, inherently waste-like, or not exempted by regulations. (Hanford)

waste management

For the purpose of this document, waste management means the generation, characterization (analysis), storage, surveillance, record keeping, and reporting of CERCLA, or other past practice waste site waste. (Hanford)

waste site

Any past practice facility or location where waste was disposed. These sites may include burial grounds, cribs, ditches, ponds, tanks, storage facilities, and other units used for the intentional or unintentional disposal or management of wastes. (WHC-CM-7-5)

weighted measuring tape

A steel tape with graduations readable to the nearest 0.01 foot. A small weight of inert material is attached to the end of the tape to ensure that the tape is plumb and to permit detection of obstructions when lowered into a well. (Hanford)

well

A well is any excavation drilled, cored, bored, washed, driven, jetted or otherwise constructed when the installation is intended for the location, diversion, artificial recharge or withdrawal of groundwater. In the context of this procedure, a well is a nontemporary installation drilled constructed and documented according to fixed requirements.

well development

The act of repairing damage to the formation caused by drilling procedures and increasing the porosity and permeability of the materials surrounding the intake portion of the well. (Groundwater and Wells)

well identification number

A unique alphanumeric identifier that is used to track well *or borehole* history and sampling results from the well. *This number will be derived from the barcode number assigned for wells which is currently implemented on site for water level readings and will consist of a five character field. This number can be assigned to a new well or borehole prior to drilling and will never change.* (Hanford) *well name*

A name assigned based on geographical location on the Hanford Site (i.e. a 600 area well is assigned a number based on its distance from a imaginary 0,0 point near the FFTF). This number will be maintained for wells only so that field personnel can easily approximate the general location of a well.

witness

A sampling team member who participates in the actual sampling or who is an observer to the sampling and is responsible for initial custody of the samples. (Hanford)

#	Abbreviation	Number/Title
18.	Hanford	Terms and Definitions used at the Hanford Site.
19.	RL-TPA-90-0001	RL-TPA-90-0001, Hanford Federal Facility Agreement and Consent Order Handbook.
20.	WHC-SP-0660	WHC-SP-0660, Hanford Environmental Information System (HEIS) Operator's Manual.
21.	OSWER 9355.0-14	OSWER Directive 9355.0-14, A Compendium of Superfund Field Operations Methods.
22.	Strategy Document	Strategy for Handling and Disposing of Purgewater at the Hanford Site, Washington, July 1990.
23.	QAMS-005	QAMS-005/80, Interim Guidelines and Specification for Preparing Quality Assurance Plans.
24.	SW-846	SW-846, Test Methods for Evaluating Solid Waste.
25.	TPA	89-10, Hanford Federal Facility Agreement and Consent Order. (Tri-Party Agreement)
26.	USBM	U. S. Bureau of Mines, A Dictionary of Mining, Mineral, and Related Terms.
27.	WAC 173-160	WAC 173-160, Minimum Standards for Construction and Maintenance of Water Wells.
28.	WAC 173-303	WAC 173-303, Dangerous Waste Regulations.

ACRONYMS

% LEL	Percent of the Lower Explosive Limit
AAMS	Aggregate Area Management Study
ALARA	As Low As Reasonably Achievable
AOU	American Ornithological Union
ASTM	American Society for Testing Materials
ATV	All-Terrain Vehicle
BIDEF	Borehole Identification and Data Entry Forms
BIODEF	Biota Identification Data Entry Form
BOC	Bottom of Casing
CA	Collection Area
CABF	Cochran's Approximation to the Behrens-Fisher
CAR	Corrective Action Quest
CBS	Core-Barrel Sampling
CCBS	Conventional Core-Barrel Sampling
CDP	Common Depth Point
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CE	Cognizant Engineer
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
CMAT	Controlled Manual Action Transmittal
CMDCR	Controlled Manual Document Change Request
CMRAS	Controlled Manual Review and Approval Sheet
COC	Chain of Custody
CPA	Commercial Pesticide Applicator
CPO	Commercial Pesticide Operator
CRQL	Contract Required Quantification Limit
CPR	Cardiopulmonary Resuscitation
CRZ	Contamination Reduction Zone
cs	Carbon Steel
D&D	Decontamination and Decommissioning
DB	Drive Barrel
DCG	Derived Concentration Guides

DE	Drilling Engineer
DI	Deionized
DIC	Document Identification Codes
DOE	U.S. Department of Energy
DOE-HQ	Department of Energy-Headquarters
DOT	U.S. Department of Transportation
DOW	Description of Work
DWPH	Dual Wall Percussion Hammer
DQOs	*Data Quality Objectives*
EA	Environmental Assurance
ECN	Engineering Change Notice
EDMC	Environmental Data Management Center
EDT	Engineering Data Transmittal
EE/CA	Engineering Evaluation/Cost Analysis
EFS	Environmental Field Services
EH&PS	Environmental Health & Pesticides Services
EII	Environmental Investigations Instruction
EMI	Electromagnetic Induction
ENV	Environmental Division
EP	U.S. Environmental Protection Agency
EPA	Environmental Protection Agency
ERA	Expedited Response Action
ERE	Environmental Restoration Engineering
EPIC	Environmental Restoration Program Information Center
ESP	Electric Submersible Pump
EV	Electron Volts
FAR	Field Activity Report
FC	File Custodian
FFC	Field File Custodian
FFT	Fast Fourier Transforms
FG	Facility Generator
FID	Flame Ionization Detector
FS	*Feasability Study*
FTC	Field Team Coordinator

FTL	Field Team Leader
FTL/CE	Field Team Leader/Cognizant Engineer
GC	Gas Chromatograph
GEN-O	General Regulations and Practices for Radiation Work
GEOS	Geosciences Group
GL	Ground Level
GMEO	Ground Maintenance and Equipment Operations
GWMS	Groundwater Monitoring System
GRP	Groundwater Resource Protection
GRPRC	Groundwater Resource Protection Regulatory Compliance
GWS	Groundwater Well Services
HA	Hazards Assessment
HASM	Hanford Analytical Services Management
HASP	Health and Safety Plan
HCU	Handheld Computer Unit
HEHF	Hanford Environmental Health Foundation
HEIS	Hanford Environmental Information System
HGSL	Hanford Geotechnical Sample Library
HMSR	Hazardous Material Shipment Record
HP	Health Physics
HP	Hydrostar Model 8001 Pump
HPT	Health Physics Technician
HRL	Horn Rapids Landfill
HSO	Health and Safety Officer
HT	Hard Tool
HWDAR	Hazardous Waste Disposal Analysis Record
HWOP	Hazardous Waste Operations Permit
HWSMC	Hazardous Waste Site Management Contractor
IAEA	International Atomic Energy Agency
IAR	Instruction Approval Release
IAW	In accordance with
IC FORM	Interim Control of Unknown, Suspected Hazardous, Suspected Mixed, and Radioactive Waste Form
ICA	Instruction Change Authorization
ID	Inside Diameter

IDW	Investigation-Derived Waste
IFS&M	Inactive Facilities Surveillance and Maintenance
IP	Instruction Package
IRM	Information Resource Management
IRR	Information Release Request
JSA	Job Safety Analysis
KEH	Kaiser Engineers Hanford Company
LCL	Lower Control Limit
LEL	Lower Explosive Limit
LFI	*Limited Field Investigation*
LLWSDR	Low Level Waste Storage/Disposal Record
LOI	Letter of Instruction
MCBS	Masonry Core-Barrel Sampling
M&TE	Measuring and Test Equipment
M & O	Maintenance and Operations
MSA	Mine Safety Appliances
MSDS	Material Safety Data Sheets
MSIN	Mail Stop Identification Number
N/A	Not Applicable
NCR	Nonconformance Reports
NIOSH	National Institute for Occupational Safety and Health
N/R	Not Required
ND	Not Documented
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
Nom	Nominal
NRC	Nuclear Regulatory Commission
NTU	Nephelometric Turbidity Units
OD	Outside Diameter
OHS	Occupational Health and Safety
OHPSS	Operational Health Physics Site Surveillance
OJT	On-The-Job Training
ORRSR	Onsite Routine Radioactive Shipment Record
ORSR	Onsite Radioactive Shipment Record

OSHA	Occupational Safety and Health Administration
OSPC	Off-Site Property Control
OSS	Operations Support Services
OU	Operable Unit
OVA	Organic Vapor Analyzer
OVM	Organic Vapor Monitor
PARCC	Precision, Accuracy, Representativeness, Comparability, Completeness
PCB	Polychlorinated Biphenyl
PCR	Procedure Comment Record
PCT	Pest Control Team
PE	Performance Evaluation
PE	Project Engineer
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PIR	Problem Identification Report
PJSP	Pre-Job Safety Plan
PNL	Pacific Northwest Laboratories
POC	Point of Contact
POP	Plant Operations Procedure
PPE	Personal Protective Equipment
QA	Quality Assurance
RA	*Remedial Action*
RAD	Radiation Detection Instruments (e.g., Count-rate meters, Micro-R meters)
RCRA	Resource Conservation and Recovery Act
RCW	Regulatory Code of Washington
RD	*Remedial Design*
REL	Recommended Exposure Limit
RFI	*RCRA Facility Investigation*
RFI/CMS	RCRA Facility Investigations/Corrective Measure Studies
RI	*Remedial Investigation*
RI/FS	Remedial Investigation/Feasibility Study
RIDS	Records Inventory and Disposition Schedule
RL	U.S. Department of Energy, Richland Field Office

RMA	Radioactive Material Area
ROR	Record of Revision
RPP	RCRA Past Practice
RSR	Radioactive Shipping Record
RWP	Radiation Work Permit
SAA	Satellite Accumulation Area
SAP	Sampling and Analysis Plan
SAR	Sample Analysis Request
SARP	Safety Analysis Review for Packaging
SCA	Surface Contamination Area
SCBA	Self-Contained Breathing Apparatus
SDAR	Storage/Disposal Approval Record
SD	Supporting Document
SDG	Sample Delivery Group
SEAC	Safety and Environmental Advisory Council
SIDEF	Sample Identification Data Entry Form
SPC	Statistical Process Control
SQC	Statistical Quality Control
SSO	Site Safety Officer
SOW	Statement of Work
SS	Site Services
ss	Stainless Steel
ST	Split Tube
SWAS	Solid Waste Acceptance Service
SWDU	Solid Waste Disposal Unit
TD	Total Depth
TEGD	Technical Enforcement Guidance Document
TFO	Tank Farm Operations
TLV	Threshold Limit Value
TOC	Total Organic Carbon
TOX	Total Organic Halogens
TSD	Treatment, Storage, and Disposal
TSF	Temporary Storage Facility
TST	Technical Support Team

TWA	Time Weighted Average
UCL	Upper Control Limit
U&T	Utilities and Transportation
UEL	Upper Explosive Limit
VG	Vertical-gradient
WAC	Washington Administrative Code
WASDA	Washington State Department of Agriculture
WBGT	Wet Bulb Globe Temperature
WCBS	Wireline Core-Barrel Sampling
WHC	Westinghouse Hanford Company
WIDS	Waste Information Data System
WSDR	Waste Storage/Disposal Request